

Report of the
**New Hampshire
Exotic Aquatic Species
Program**



1999-2001

April 2002



Report of the New Hampshire Exotic Aquatic Species Program

April 2002

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Executive Summary

This report summarizes the spread and distribution of exotic aquatic species in New Hampshire and the activities of New Hampshire's Exotic Aquatic Species Program to control these species. Program history is summarized, and activities that occurred from 1999 through 2001 are described in detail.

“Exotic aquatic species” are plants or animals that are not part of New Hampshire’s native aquatic flora and fauna. Since the first exotic aquatic plant infestation in New Hampshire was discovered in 1965 in Lake Winnepesaukee, exotic aquatic plant infestations have increased to a total of 58 infestations in 53 waterbodies in 2001. Species present include variable milfoil (48 waterbodies), Eurasian milfoil (2 waterbodies), fanwort (6 waterbodies), water chestnut (1 waterbody) and Brazilian elodea (1 waterbody). Most of these exotic plants can propagate by fragmentation as well as by seed.

Exotic aquatic plant fragments can easily become attached to aquatic recreational gear such as boats, and can spread from waterbody to waterbody with transient boating activities. Infestations can have detrimental effects on the ecological, recreational, aesthetic, and economic values of the state’s precious surface waters, limiting use of the waterbodies and decreasing shorefront property values by as much as 16% according to a UNH Study.

Since its inception in 1981 with the passage of RSA 487:15, the Exotic Aquatic Species Program has grown to a cooperative effort among state agencies, lake organizations, and concerned citizens. At the state level, this involves a partnership among the New Hampshire Department of Environmental Services (NHDES), the Department of Fish and Game, the Department of Safety, and the Department of Agriculture, Markets, and Foods to prevent the spread of exotic plants to new waterbodies and to monitor and treat infestations. Many lake associations and other non-profit organizations, such as the New Hampshire Lakes Association, participate in monitoring, education, and control efforts.

Recent Program Activities

Program activities include five focus areas: Prevention of new infestations through education and outreach; monitoring for early detection of new infestations; control of new and established infestations; research towards new control methods; and regional/ national cooperation with other exotic species programs.

Education and Outreach: Between 1999 and 2001, 68 presentations and seminars were given to lake associations and professional organizations, as well as several live radio broadcasts and local news media events. A new web page was developed in 2000, and over 200 boat launch sites now have colorful signs to inform boaters about potential infestations in a waterbody.

Monitoring for Early Detection: Between 1999 and 2001, monitoring activities included macrophyte surveys by NHDES staff of 117 lakes. The Weed Watcher Program, coordinated by NHDES, recruits volunteers to monitor their waterbodies and to report suspicious plants to NHDES for immediate identification. In 2001, there were over 160 trained Weed Watchers monitoring approximately 80 waterbodies for early detection of exotics.

Control Activities for New and Existing Infestations: Control activities grew rapidly from 24 individual projects in 1999, to 37 in 2001. Control measures for new, small infestations usually include hand pulling or benthic barriers, and may include designation of a Restricted Use Area in the vicinity of the infestation. Larger, established infestations are usually controlled with herbicides. Project activities for 2001 included 20 herbicide applications, 5 benthic barrier installations, 5 hand-pulling activities, 1 harvesting experiment, and 4 Restricted Use Area designations.

Research: Initiating and participating in research activities is a key element in the Exotic Aquatic Species Program. As variable milfoil is not a common nuisance species throughout the United States, little research has been conducted on the plants' biology, ecological relationships, and potential control strategies. By working with local colleges and universities like Dartmouth and the University of New Hampshire, as well as field-testing various hypotheses on New Hampshire waterbodies, NHDES is able to work towards finding solutions to exotic aquatic plant infestations.

Regional Cooperation: NHDES has worked on a regional level to standardize the key legislation and education initiatives between the New England states. To date, New Hampshire, Vermont and Maine have state exotic species legislation in place. Prohibition of exotic species sale and transport is much more effective on a regional basis than state-by-state. If a standardized list of exotic plants can be prohibited in New England and neighboring states, the likelihood of success in preventing the spread of these species to new waterbodies is increased. To carry out this goal, NHDES has presented information on the New Hampshire Program to Maine and Pennsylvania, and has provided information and annual reports to New York, Connecticut, and Massachusetts. NHDES is also active in numerous regional groups and organizations dealing with management, research, and sharing education and outreach resources.

The NHDES Exotic Aquatic Species Program is funded from a fee of \$1.50 per boat registration. Both income and expenditures have grown between 1998 and 2001. In 1998, program income was \$97,000 and expenditures were \$40,000. Program income in 2001 was \$147,000 and expenditures were \$181,000. Expenditures in 2001 exceeded income due to a significant increase in the number of herbicide applications for plant control, reducing the overall fee account balance.

Long Term Goals

The goals of the Exotic Aquatic Species Program are to limit the further spread of exotic aquatic species, control new and existing infestations, and to research new ways to contain or even reverse spread of these species. Objectives in the five focus areas are:

Outreach and Education: Foster increased partnerships among public and private lake associations, state agencies, regional groups, and other aquatic interests to provide and disseminate innovative and proactive educational materials that inform the public about exotic aquatic species, how they are spread, and how they are controlled.

Monitoring for Early Detection: Expand the Weed Watcher Program and coordinate training activities with volunteer monitors. Map infestations using global positioning systems to more accurately document and track the occurrence and distribution of infestations over time. Develop DNA gene sequencing methods for positive identification of variable milfoil during all life stages.

Control: Develop a streamlined process, including appropriate monitoring and environmental assessment, for conducting herbicide applications.

Research: Conduct research on long-term control methods and potential means for eradication of exotic aquatic plants. With Dartmouth College, develop DNA gene sequencing methods for positive identification of variable milfoil during all life stages. With the University of New Hampshire, further research the economic impacts of exotic plant infestations, such as impacts on New Hampshire lakefront property values.

Regional Cooperation: Continue to develop regional approaches for the northeastern states for education, outreach and monitoring.

Looking to 2002 and beyond, we would like to see the program meet the challenge of preventing new exotics infestations, controlling existing ones, and researching new techniques for control and even eradication of exotic aquatic species. There is much to be done.

This year the New Hampshire Lakes Association (NHLA) has partnered with the program to secure federal funding in 2002 for enhanced education and outreach, as well as grants to local organizations for boat launch monitoring.

In its 2002 session, the New Hampshire General Court is also considering legislation that would substantially increase funding and program capability for boat launch monitoring and exotics research.

1. PROGRAM OVERVIEW

1.1 Purpose

This report summarizes the spread and distribution of exotic aquatic species in New Hampshire and the efforts of New Hampshire's Exotic Aquatic Species Program to control these species. Program history is summarized, and activities that occurred from 1999 through 2001 are described in detail.

1.2 Introduction

"Exotic aquatic species" are plants or animals that are not part of New Hampshire's native aquatic flora and fauna. Sometimes called 'nuisance' or 'invasive' species, these organisms can grow and reproduce rapidly, taking over large portions of waterbodies and impairing boating, recreation, and aesthetics as well as posing a threat to native species. Recent studies by the University of New Hampshire have documented 16% declines in lakefront property values attributed to the presence of exotic aquatic plants (Halstead et al., 2001).

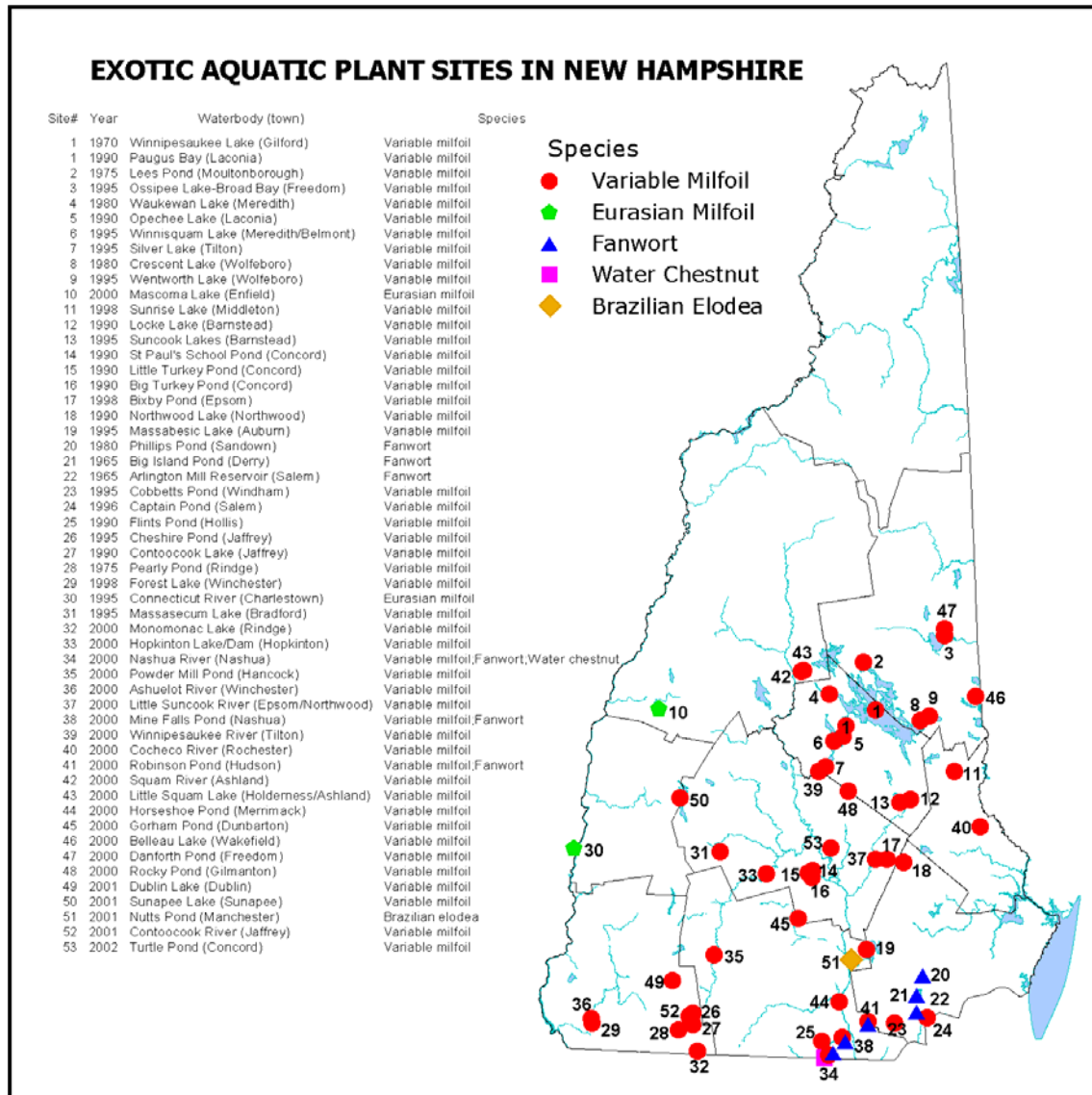
New Hampshire's Exotic Aquatic Species Program, authorized primarily by RSA 487, focuses on submerged exotic aquatic plants, including variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), fanwort (*Cabomba caroliniana*), Brazilian elodea (*Egeria densa*), Hydrilla (*Hydrilla verticillata*) and water chestnut (*Trapa natans*), although other species such as the zebra mussel (*Dreissena polymorpha*) and purple loosestrife (*Lythrum salicaria*) are also of concern.

Exotic aquatic species can easily become attached to boats, trailers, fishing equipment, and diving gear, thus spreading from waterbody to waterbody. Recreational boat registrations in New Hampshire have grown over 20% since 1997, to more than 100,000 registrations in 2001. Consequently, with increasing water-based recreational activities, there is significant potential for the migration of exotic aquatic species into and between New Hampshire's waterbodies from boats and other water-related recreational equipment.

Fifty-three waterbodies, all located in central and southern New Hampshire, are infested with one or more submerged exotic aquatic plant species (Figure 1-1). Forty-eight waterbodies have variable milfoil, two waterbodies have Eurasian milfoil, one has water chestnut, six have fanwort, and one waterbody has a new infestation of Brazilian elodea that was just documented in 2001.

The primary "exotic aquatic animal" of concern to New Hampshire is the zebra mussel. The zebra mussel has been identified in waterbodies across the United States and continues to spread in neighboring and nearby states like Vermont, Connecticut, and New York. New Hampshire, along with Maine and Massachusetts, is still free from the zebra mussel. Other exotic animals, such as the spiny water flea (*Bythotrephes cederstroemi*) and the round goby (*Neogobius melanstomus*), are also altering native food webs throughout the Great Lakes. These could threaten New Hampshire lakes in the future.

Figure 1-1



1.3 History

The first exotic aquatic plant infestation in New Hampshire was discovered in 1965 in Lake Winnepesaukee. Exotic aquatic plant infestations have increased to a total of 58 infestations on 53 waterbodies in 2001. Figure 1-2 depicts the trend of exotic aquatic plant infestations from 1960-2001. Four fanwort infestations were documented in the 1960s, but due to a lake dredge during the early 1980s, fanwort in Milville Lake was eradicated, leaving only three infestations. As of 1999, fanwort was documented in the Nashua River and Mine Falls Pond in Nashua, and in Robinson Pond in Hudson, bringing the total to six infestations. Water chestnut, new to New Hampshire in 1998, is currently documented in one waterbody, the Nashua River. During the summer of 2001, Brazilian elodea (*Egeria densa*) was found in Nutts Pond in Manchester. Overall, three waterbodies now have more than one species of exotic aquatic plants: Mine Falls Pond in Nashua (milfoil and fanwort), Robinson Pond in Hudson (milfoil and fanwort), and the Nashua River in Nashua (milfoil, fanwort and water chestnut).

Activities associated with the control of exotic aquatic plants formally began in 1981 with the passage of an exotic plant control law, RSA 487:15 (copies of the program legislation and regulations are included in Appendix 1). A more complete chronology of program events and activities is provided in Appendix 2. Figure 1-3 summarizes the historical trends in control practices since 1981, demonstrating the program expansion that has occurred during the last 20 years. Each year a variety of control projects are conducted. Figure 1-4 provides a summary of control activities in 2001. Table 1-1 provides a summary of key events and activities that have occurred from 1981 to 2001.

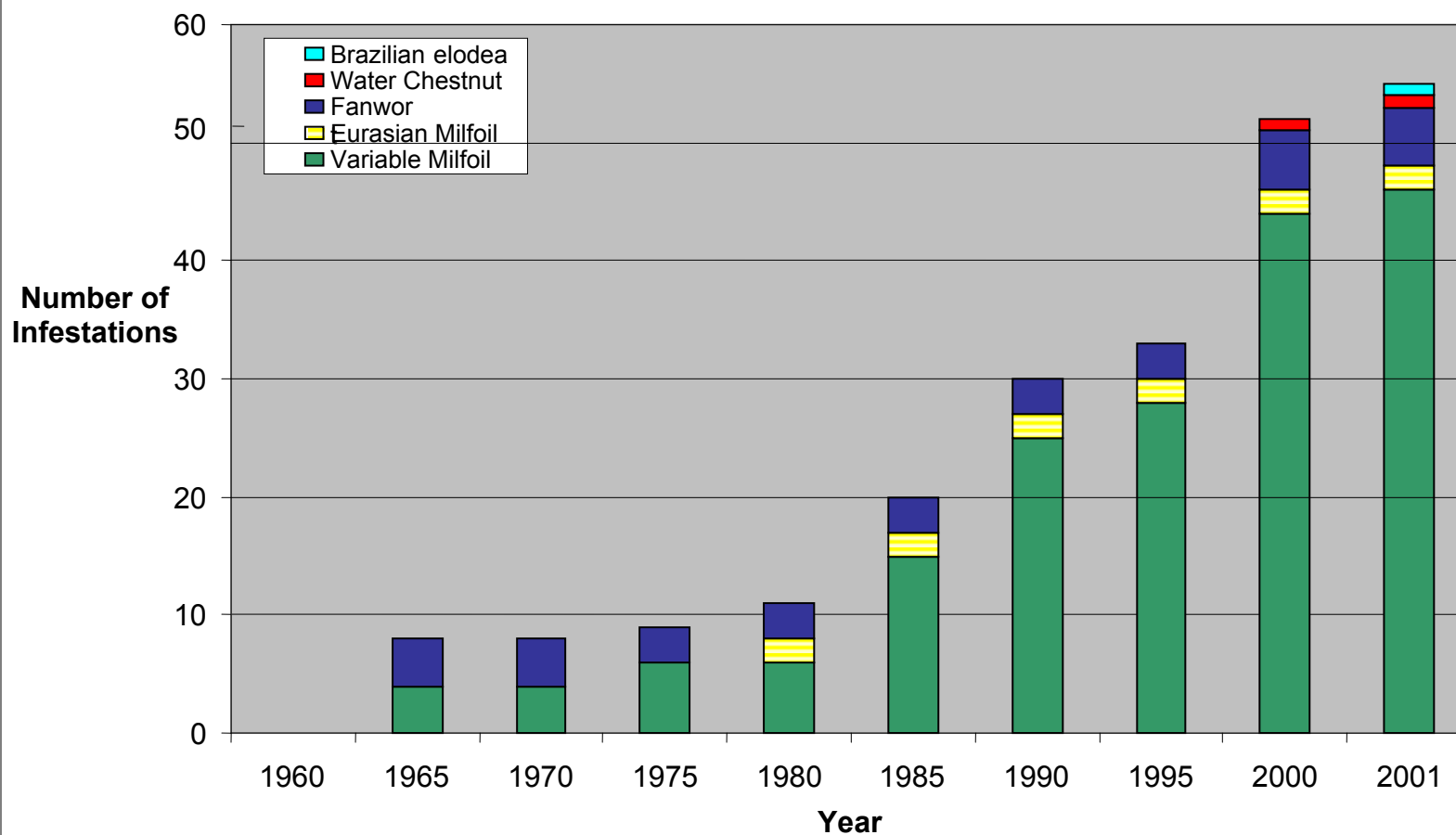
1.4 Roles

The Exotic Aquatic Species Program has grown over time as awareness of exotic aquatic species and the number of infestations has grown. New Hampshire employs a multi-faceted approach to control the spread of exotic aquatic plants. This approach has developed and evolved as a partnership among state agencies, local government, and volunteer groups. The expertise, capacity, and knowledge base of the program activities built through this partnership are key to the success of this program. These entities and roles are described in Table 1-2.

Table 1-1
Key Events in the NHDES Exotic Aquatic Species Program: 1981-2000

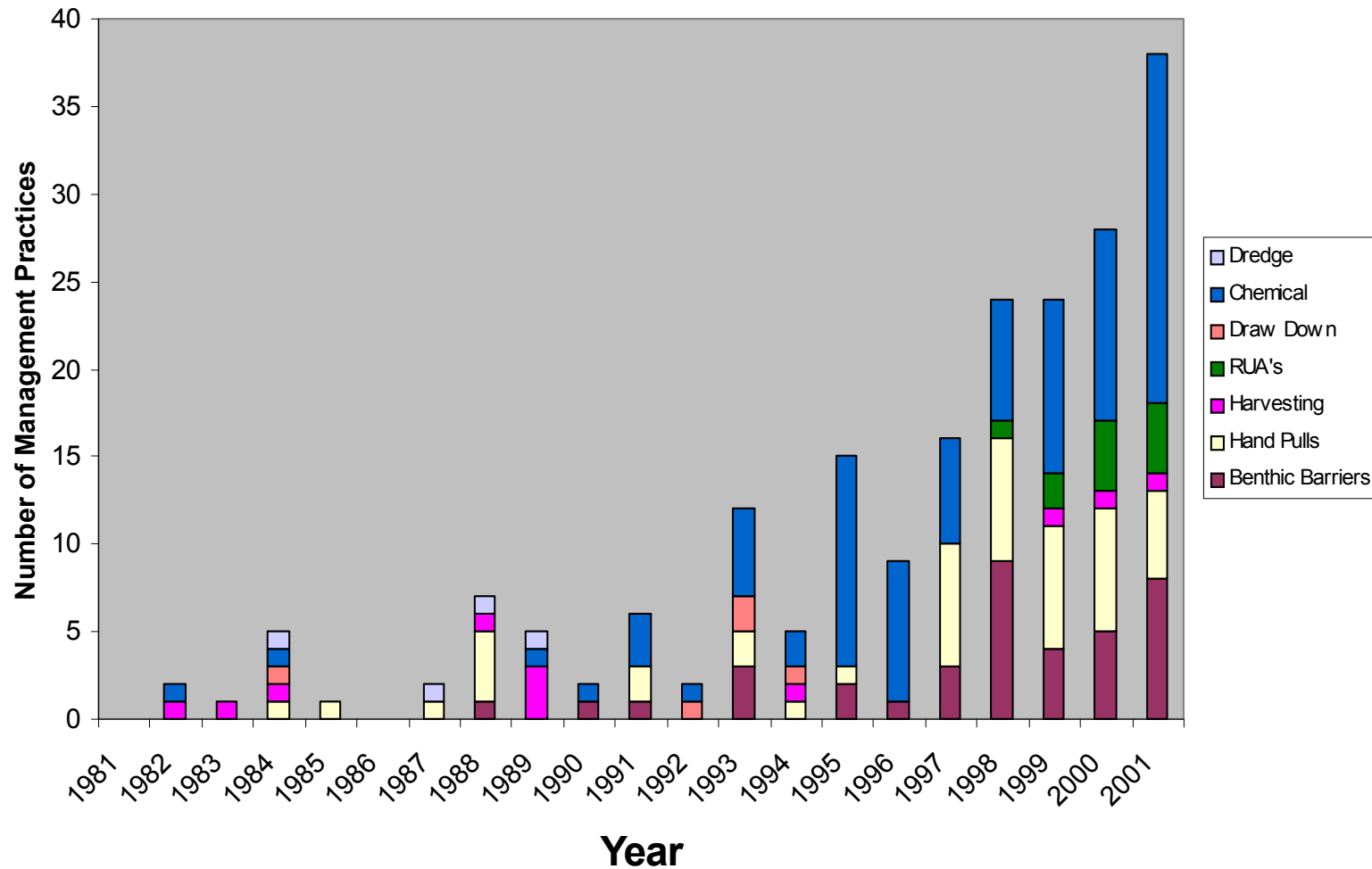
Year	Activity/Event
1981	➤ Exotic Weed Legislation (RSA 149-F:3) was enacted
1982	➤ Citizen Aquatic Weed Control Advisory Committee was formed by a group of volunteers
1984	➤ Milville Lake dredged to control a fanwort infestation
1985	➤ Exotic plant control funding suspended due to changes in legislation. No control techniques employed this year
1986	➤ Exotic plant control funding became available once again due to legislative action
1987	➤ \$45,000 grant awarded to the Aquatic Biology Department at the University of New Hampshire, Durham to determine adequate control techniques for exotic aquatic plants
1988	➤ Weed Watcher Program initiated
1991	<ul style="list-style-type: none"> ➤ Discovery of larval form of <i>Paraponyx allionealis</i> (an aquatic moth) on <i>Myriophyllum heterophyllum</i> (variable milfoil) in Lees Pond, Moultonborough ➤ Exotic aquatic species sign developed for posting at boat launch sites
1992	➤ New exotic plant found growing in Mountain Pond, Brookfield, New Hampshire (<i>Myriophyllum spicatum</i> -Eurasian milfoil)
1993	<ul style="list-style-type: none"> ➤ Aquatic plant workshop held at NHDES for lake association members and volunteers ➤ Presentation on exotic plants given to BASS Master Associations
1995	➤ Weed Watcher Wheel developed for use in identification of exotic plants
1996	➤ Instruction in identifying exotic plants was given to NH Fish and Game Department volunteers
1997	➤ Legislation passed prohibiting a number of activities associated with exotic aquatic plants
1998	<ul style="list-style-type: none"> ➤ RSA 487:16-a became effective on January 1, 1998 ➤ Administrative Rules (Env-Ws 1300) were adopted on September 5, 1998 ➤ Fourteen species of exotic aquatic plants were listed as prohibited species in rules ➤ A mailing to 700 aquatic plant retailers in New Hampshire was conducted to inform them of changes in legislation regarding the fourteen prohibited species ➤ First Restricted Use Area (RUA) established on Lake Massasecum, Bradford ➤ <i>Trapa natans</i> (water chestnut) found in Nashua River, Nashua
1999	➤ <i>Myriophyllum spicatum</i> (Eurasian milfoil) first identified in Lake Mascoma, Enfield
2000	➤ RSA 487:16-b relative to exotic aquatic plant penalties was adopted
2001	<ul style="list-style-type: none"> ➤ Amendment to Env-Ws 1304.01(a) passed ➤ First infestation of <i>Egeria densa</i> (Brazilian elodea) found in New Hampshire in Nutts Pond, Manchester ➤ Restricted Use Areas installed in Lake Sunapee and Squam Lake

Figure I-2
Documented Exotic Aquatic Plant Infestations in New Hampshire



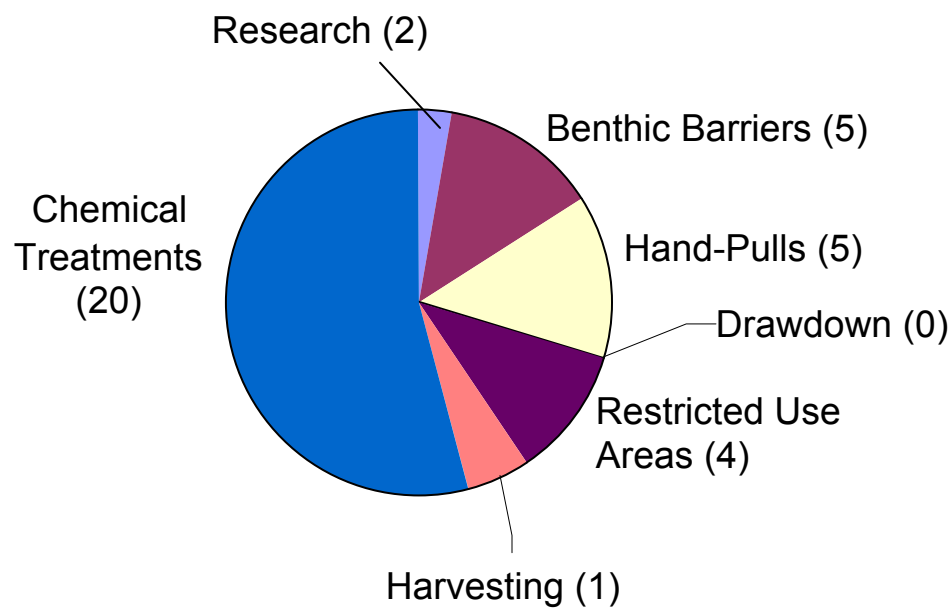
Source: NHDES Exotic Aquatic Species Program Files, 2001

Figure 1-3
Summary of Control Practices: 1981-2001



Source: NHDES Exotic Aquatic Species Program Files, 2001

Figure 1-4
Exotic Aquatic Plant Control Activities in 2001



Source: Data from NHDES Exotic Aquatic Species Program, 2001

Table 1-2
Summary of Involved Organizations and Their Responsibilities

I. STATE AGENCIES
<p>Department of Environmental Services (NHDES)</p> <ul style="list-style-type: none"> Coordinates and performs education and outreach activities Coordinates and performs activities to remove or control exotic aquatic plants Develops and distributes signs and notices of infestations Manages the allocation of funds from boat registrations for education and control activities Conducts field investigations of NH waterbodies for new infestations
<p>Fish and Game Department (NHF&G)</p> <ul style="list-style-type: none"> Publishes notices of aquatic nuisance species infestations and legislation in the state Provides technical assistance for control activities associated with aquatic nuisance species Provides staff time for consultations on aquatic nuisance animals Develops and enforces rules pertaining to aquatic nuisance animals Coordinates and performs education/outreach activities Displays signs at NHF&G owned boat launch facilities
<p>Department of Safety (NHDOS)</p> <ul style="list-style-type: none"> Provides assistance in the designation and enforcement of restricted use areas on waterbodies
<p>Department of Agriculture, Markets and Food (NHDA)</p> <ul style="list-style-type: none"> Permits and oversees the chemical control of nuisance exotic plants Provides technical information on aquatic herbicides
<p>Department of Resources and Economic Development (NHDRED)</p> <ul style="list-style-type: none"> Provides information on rare and endangered species
II. OTHER ENTITIES OR ORGANIZATIONS
<p>Municipalities</p> <ul style="list-style-type: none"> Manchester Water Works performs a number of milfoil control activities on Lake Massabesic including installation of benthic barriers and designation of restricted use areas
<p>University of New Hampshire, Durham</p> <ul style="list-style-type: none"> Makes available specimens in Hodgdon Herbarium for verification of species Offers trained botanists who provide time to verify a species identification Provides outreach and education materials through the NH Lakes Lay Monitoring Program (NHLLMP) and Cooperative Extension
<p>Lake Associations</p> <ul style="list-style-type: none"> Work closely with New Hampshire Lakes Association Conduct control activities with grant assistance from NHDES Participate in weed watchers program to find new infestations Coordinate with NHDES for outreach and education activities associated with exotic aquatic plants at annual meetings Coordinate with NHDES, NHDA, and NHF&G in managing infestations of exotic aquatic species
<p>Marinas</p> <ul style="list-style-type: none"> Provide information to boaters about exotic aquatic species
<p>Private Citizens</p> <ul style="list-style-type: none"> Participate in sampling and monitoring waterbodies for changes in plant growth and aquatic chemistry Participate in NH Weed Watchers Program by frequently monitoring the littoral zone of waterbodies during the growing season Mail or deliver suspected exotic plants to NHDES for identification of species

2. EXOTIC AQUATIC SPECIES PROGRAM ACTIVITIES: 1999-2001

The primary purpose of the Exotic Aquatic Species Program is to “prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state” (RSA 487:17, II). The program has five focus areas: 1) Prevention of new infestations, 2) Monitoring for early detection of new infestations, 3) Control of new and established infestations, 4) Research towards new control methods with the goal of reducing or eliminating infested areas, and 5) Regional and national cooperation.

2.1 Prevention of New Infestations - Education and Outreach

Table 2-1 illustrates the typical educational and outreach activities offered by the Exotic Aquatic Species Program.

Table 2-1
Typical Education and Outreach Activities

Prevention of infestations by education and outreach
<ul style="list-style-type: none">• Educate boaters, anglers, and other water recreationists• Develop fact sheets and pamphlets• Develop signage for boat launch sites• Develop new materials for volunteer Weed Watchers• Speak with lake associations and other groups to promote an understanding of invasives• Disseminate information on the control options that are available for various exotic aquatic plants• Train lake associations to monitor boats and access sites• Provide technical assistance for exotic aquatic plant control

Outreach efforts are aimed at educating the public about the characteristics and control of exotic plants, including:

1. The negative environmental and economic impacts
2. Exotic aquatic plant identification
3. How exotic aquatic plants spread; and
4. How to minimize the spread

2.1.1 Presentations

From 1999 through 2001, the Exotic Aquatic Species Coordinator and the Limnology Center Director gave numerous presentations on exotic aquatic species. These presentations took place during annual lake association meetings, monthly Marine Trade Association meetings, legislative committee meetings, conservation commission meetings, BASS angler meetings, and lake management meetings. Presentations were also given at schools throughout the State, geared specifically to the grade and needs of the class. Table 2-2 presents the groups from 1999 through 2001 that received presentations. Examples of fact sheets, pamphlets, and other

materials provided at these presentations are presented in Appendix 3.

Table 2-2
Presentations and Seminars Given in 1999-2001

Group	Location	Year
Marine Trades Association	Meredith	1999
NH Wetlands Bureau	Concord	1999
New England Association of Environmental Biologists	Ascutney, VT	1999
Lake Sunapee Protective Association	Sunapee	1999
NHLA- Lake Congress for NHLA member	Auburn	1999
VLAP Volunteers	Concord	1999
Beaver Lake Improvement Association	Derry	1999
Highland Lake Association	Stoddard	1999
Little Lake Sunapee	New London	1999
Otter Pond	New London	1999
Lake Skatutakee Association	Harrisville	1999
NH Rivers Management Group	Concord	1999
Sommersworth B.A.S.S. Organization	Sommersworth	1999
Meredith Rotary Club	Meredith	1999
Hampstead B.A.S.S. Organization	Hampstead	1999
Massachussetts B.A.S.S. Association	Hudson, MA	1999
Monadnock B.A.S.S. Organization	Fitzwilliam	2000
Abenaki B.A.S.S. Anglers	Bellows Falls, VT	2000
Northeast Aquatic Plant Management Society	Suffern, NY	2000
Granite State B.A.S.S.	Nashua	2000
Contoocook River Association	Contoocook	2000
NH B.A.S.S. Federation	Concord	2000
Glen Lake Association	Goffstown	2000
NH A.B.A.	Manchester	2000
New England Chapter of the North American Lake Management Society	Storrs, CT	2000
NH Lakes Congress	Ashland/Holderness	2000
Franklin Area Health Officers	Franklin	2000
Forest Lake	Winchester	2000
Lake Sunapee PA	Sunapee	2000
Squam Lake Association	Holderness	2000
Loon Pond	Gilmanton	2000
Harris Center Members	Stoddard	2000
Lake Mascoma	Enfield	2000
Crystal Lake	Enfield	2000
Lake Massasecum Summer Camp	Bradford	2000
Lovell Lake	Wakefield	2000

Group	Location	Year
Tuftonboro lake residents	Tuftonboro	2000
Connecticut River Association	Charlestown	2000
Pennsylvania Lake Management Society	Harrisburg, PA	2000
St. Anselm College Natural Resources Class	Goffstown	2000
Moultonboro Academy	Moultonboro	2000
Keene Lyons Club	Keene	2000
University of New Hampshire Lake Management Class	Durham	2000
Milville Lake	Salem	2000
Crystal Lake	Enfield	2001
Mascoma High School Students	Enfield	2001
Manchester Ponds Association	Manchester	2001
Washington Lake	Washington	2001
Spaulding High School	Rochester	2001
Pleasant Lake	Deerfield	2001
Lake Sunapee	Sunapee	2001
Great East Lake	Wakefield	2001
Newfound Lake Association	Bristol	2001
Lovell Lake Association	Wakefield	2001
Mountain View Lake Association	Meredith	2001
Pleasant Lake	Elkins	2001
Squam Lake Association	Holderness	2001
Partridge Lake Association	Littleton	2001
Baboosic Lake	Amherst	2001
Crystal Lake	Manchester	2001
Otter Pond	Sunapee	2001
Granite Lake	Stoddard	2001
Spofford Lake	Spofford	2001
Crescent Lake	Acworth	2001
Blaisdell Lake	Sutton	2001
Friends of Hudson Lakes	Hudson	2001
Lake Winnepesaukee Association	Laconia	2001
Milville Lake	Salem	2001

2.1.2 Participation in Lake Festivals and Environmental Events

In addition to presentations at annual meetings and other gatherings of smaller groups, the Exotic Aquatic Species Coordinator attends annual lake festivals, conferences, and environmental awareness festivals throughout the state. At these events written materials were provided for distribution while the coordinator interacted on an individual basis with interested members of the public. Live specimens of exotic plants and look-alike native species were also on display for close examination and comparison during these events. These events included Celebrate Your Lakes Day festivals, Discover Wild New Hampshire Day, the New Hampshire Farm and Forest

Expo, Hopkinton Envirofest, NHDES Rivers Conference, NHDES VLAP Conference, Northeast Aquatic Plant Management Society Conferences, an Exotic Share Fair, boat shows, New England Chapter of the North American Lake Management Society Conferences, the New Hampshire Lake Association Conference, and the Naturally Newfound Festival.

2.1.3 Dissemination of Exotic Aquatic Species Information through Multi-Media Approaches

The Exotic Aquatic Species Program was the focus of three live radio broadcasts in 2000, including one on NH Public Radio, one lakes region radio station, and the other on a local radio station out of New London.

Another mechanism of media publicity was through several interviews and local coverage by Channel 9 News. Several times during the summers of 2000 and 2001 DES worked with Channel 9 to broadcast information about control practices, preventative measures, and proactive approaches to exotic aquatic plant control.

A new web page for the Exotic Aquatic Species Program was developed in 2000. The web page is housed on the NHDES web site, and can be accessed at <http://www.des.state.nh.us/wmb/exoticspecies/>. The website provides links to identification information, weed watching information, distribution maps, and copies of fact sheets and exotic aquatic species legislation and regulations.

Colorful signs with detailed diagrams were posted at over 200 boat launch sites throughout the State. NHDES coordinated with both the New Hampshire Fish and Game Department and the New Hampshire Department of Resources and Economic Development to have signs posted at each of the state owned launch sites. These signs inform boaters about exotic plant infestations, and where to look on their recreational equipment for tag-along plant fragments. Examples of each type of sign are included in Appendix 4.

2.2 Early Detection - Monitoring and Identification

2.2.1 NHDES Monitoring

As a part of the regular NHDES monitoring activities, lake assessments are conducted on a number of lakes each year. Between 1999 and 2001, NHDES biologists conducted aquatic macrophyte mapping as an element of lake assessments at 117 lakes. Any new or existing infestations of exotic aquatic plants were documented and mapped, and control actions were taken based on the status of the infestation. One new infestation of variable milfoil was found in Turtle Pond in Concord during these surveys.

In summer 2001 NHDES, in association with the University of New Hampshire, worked with the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) to conduct a survey of the nurseries in the state that sell aquatic plants. The primary purpose of the survey was to determine if an invasive species to

the southern United States, giant salvinia (*Salvinia molesta*), is being sold in New Hampshire. This plant is often a contaminant in the root systems of aquatic plants sold across the country. In addition to checking the nurseries for salvinia, NHDES interns conducted a full survey to determine if any New Hampshire listed and prohibited exotic aquatic species were being offered for sale. Data analysis for this survey will begin in February of 2002.

2.2.2 Volunteer Weed Watcher Program

The goal of this program is to promote a volunteer, or grass-roots effort, to monitor lakes, ponds, and rivers for exotic aquatic plants. Because eradication of established exotic plant infestations is rarely possible, early detection is of utmost importance. Trained Weed Watchers provide an important service and function to New Hampshire by monitoring our waterbodies for potential new infestations. This allows NHDES biologists to respond rapidly to new infestations.

Weed Watcher volunteers are trained by the Exotic Aquatic Species Coordinator to identify plants that are common in their waterbody. Typically, training involves accompanying volunteers in the field to identify plants within their chosen waterbody. If no exotics are present, the Coordinator will provide specimens of exotic aquatic plants for the volunteers to become familiar with. Volunteers are also supplied with existing vegetation maps for their waterbody, a Weed Watcher Kit, and instructions to report any new infestations immediately.

Weed Watcher volunteers survey their waterbody once each month from May through September for any new plant growth, patrolling the shallow zones of their lakes and mapping the vegetation they observe. The volunteers provide survey information to NHDES for entry into a database, and they are encouraged to collect specimens of any unfamiliar plants and deliver them to NHDES to confirm identification. In 2001, there were over 160 trained Weed Watchers monitoring approximately 80 waterbodies for early detection of exotics. This does not include a number of volunteers from the Volunteer Lake Assessment Program that participate on an "unofficial" basis.

Events during summer 2001 on Dublin Lake are a prime example of the success of the Weed Watcher Program. During the June Weed Watcher survey by volunteers from the Dublin Lake Association, one volunteer found a new small patch of variable milfoil in a cove of the lake. Because of early detection by Weed Watchers, NHDES divers were able to hand pull a large number of the plants and then cover the remaining area with bottom barriers. The infestation is now contained. Similar success stories are occurring more often as awareness of the plants increases.

NHDES has received requests for advanced monitoring methodologies, including establishing a 'launch watch' program for the public access ramps on their waterbodies. Due to staffing limitations, NHDES has not been able to provide staff for these launches. A program goal for future efforts is the development of a cost effective means to monitor public launches during peak usage. Launch monitoring would provide one more tool to help prevent new infestations. For example, during the summer of

2001, volunteers with the Lake Sunapee Protective Association found a stem of Eurasian milfoil attached to a boat trailer that was launching into Lake Sunapee. The Launch Monitors removed the plant from the boat trailer before it made its way into the lake.

Fortunately, many of the plants that were logged over the 1999-2001 seasons were native plants. Table 2-3 lists the exotic aquatic plants that were found during the surveys. These infestations would have spread rapidly if not for the early detection by the Volunteer Weed Watchers.

Table 2-3
Exotic Aquatic Plant Infestations Identified by Weed Watchers
from 1999 through 2001

Waterbody	Town	Exotic Aquatic species	Year
Mascoma Lake	Enfield	Eurasian milfoil	1999
Belleau Lake	Wakefield	Variable milfoil	1999 (Verified 2000*)
Gorham Pond	Dunbarton	Variable milfoil	2000
Horseshoe Pond	Merrimack	Variable milfoil	1999 (Verified 2000*)
Little Squam Lake/Squam River	Holderness/Ashland	Variable milfoil	2000
Danforth Pond	Ossipee	Variable milfoil	2000
Rocky Pond	Gilmanton	Variable milfoil	2000
Dublin Lake	Dublin	Variable milfoil	2001
Lake Sunapee (Georges Mill)	Sunapee	Variable milfoil	2001
Nutts Pond	Manchester	Brazilian elodea	2001

*These infestations were present prior to this year, but the plants did not flower until the year specified in the table above. Without a flower structure accurate identification is not possible.

2.3 Control

The Exotic Aquatic Species Program relies on a number of methods to manage exotic plant infestations, including physical control, mechanical control, chemical control, biological control, and habitat manipulation. Table 2-4 outlines each control technique, including information on target specificity, advantages, disadvantages, and the approximate cost of each method (as of a 1997 cost analysis by Aquatic Control Technologies, Inc). Criteria to evaluate the selection of control techniques are presented in Appendix 5.

A number of techniques were employed in the control of exotic aquatic plants from 1999 through 2001. These control activities took place on waterbodies throughout the state. Table 2-5 provides details on specific projects.

Table 2-4
NHDES Exotic Aquatic Species Program: Plant Control Techniques

Action	Effectiveness	Specificity to Target	Advantages	Disadvantages	Cost*
Hand Pulling (Physical)	Removes a few individual plants at time	High	Good for localized areas/ few plants Plants physically removed from waterbody	Labor intensive Good for small infestations only. Not practical when plant growth is dense	Labor Costs vary depending upon contractor costs or staff time
Mechanical Harvesting (Physical)	Removes large amounts of vegetation at a time	Not specific	Rapidly removes vegetation from area Plants physically removed from waterbody	Fragments plants which could cause regrowth Removes beneficial native vegetation. Could increase turbidity, ultimately affecting other aquatic life Does not remove rooting systems	Ranges widely depending on plant density, location, disposal, etc. Generally \$350-\$1500 per acre
Hydro-raking (Physical)	Removes large amounts of vegetation at a time	Not specific	Rapidly removes vegetation Removes rooting systems to prevent rapid regrowth. Plants removed from waterbody	Fragments plants Could increase turbidity, ultimately affecting other aquatic life Removes beneficial native vegetation	Ranges widely depending on plant density, location, and disposal. Generally \$350-\$2500 per acre
Benthic Barrier permeable (Physical)	Used for very small infestations	Specific to area where barrier is located Impacts all plants under barrier	Compresses plants to sediments and prevents likelihood of fragmentation by wind, wave, or anthropogenic means	Labor intensive Must frequently be cleaned/re-staked Plants not physically removed from waterbody May cause sediment/water anoxia May impact non-target species such as fish	\$0.60-\$1.22 per square foot or (\$25,000-\$50,000 per acre)

Action	Effectiveness	Specificity to Target	Advantages	Disadvantages	Cost*
Chemical Treatment	Herbicides which are taken up by root systems (systemic herbicides) more effective than contact herbicides	Most chemicals have target species for which they are most effective Varying application rates can increase target specificity	Chemical has potential to eliminate exotic plant infestation if done at correct time, and if correct concentration is used Relatively rapid effect Longer time span of control than other types of control techniques	Addition of chemical to waterbody May impact non-target species if not applied according to label restrictions Could be environmentally damaging if not applied per label restrictions	Varies with chemical and size of treatment area Could range from \$200-\$1000 per acre.
Drawdown (Habitat manipulation)	Somewhat effective if repeated frequently More effective if drawdown maintained for long time period	Not specific	Could control density of vegetation due to plant die off from desiccation or freezing Winter drawdowns favorable	Impacts non-target plants Impacts fish, amphibians, insects, and other aquatic organisms Devastating to entire waterbody ecology	Low cost if dam or other means of drawing down water is available
Dredging (Habitat manipulation)	Effective in removing plants from localized area where dredge takes place	Not specific	Completely removes plant material Removes nutrient laden sediments Removes seed bank	Devastating to entire system. Impacts non-target plants and animals Could cause excessive turbidity Must wait for waterbody fill	\$16,000-32,000 per acre Previously used and successful in one lake in New Hampshire (Milville Lake)

Action	Effectiveness	Specificity to Target	Advantages	Disadvantages	Cost*
Biological Controls	Effective against target plants	Specific	<p>Insects, bacteria, or viruses used in this method are typically specific to target plant. Their life cycles revolve around particular plant species</p> <p>Does not affect other non-target species</p>	<p>May cause decline in oxygen as plant material decays</p> <p>Many biological controls are themselves exotic</p> <p>Still experimental</p>	<p>Cost of insects</p> <p>Monitoring cost high</p>

*Costs are averages determined from data obtained from "Draft Generic Environmental Impact Report" for Massachusetts, and from Aquatic Control Technology, Inc. Fact Sheet.

Table 2-5
Summary of 1999 through 2001 Control Projects

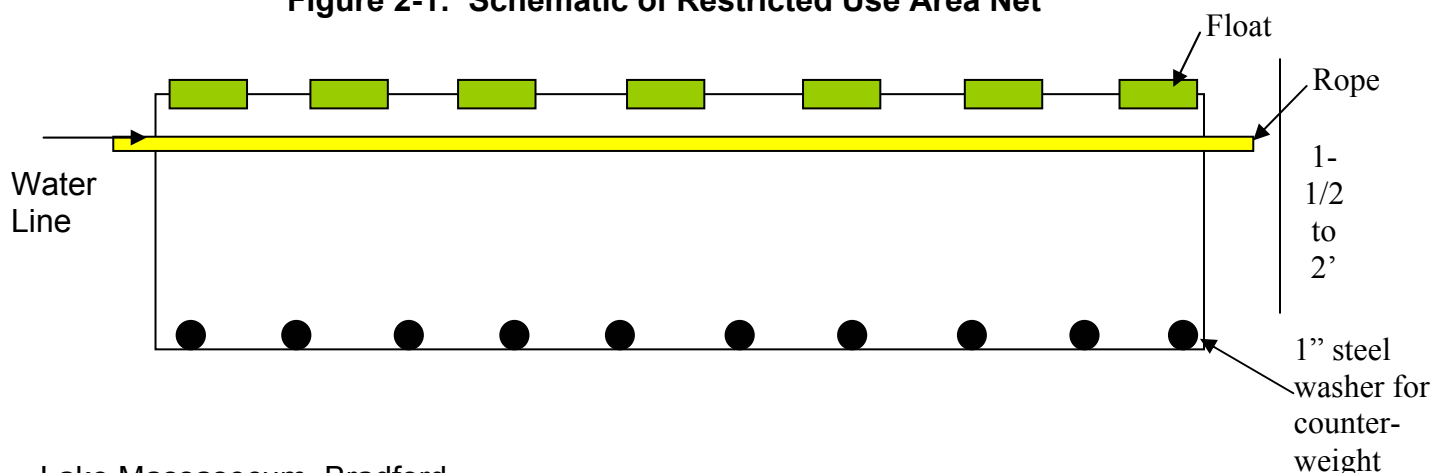
Waterbody/Town	Innovative	Benthic Barriers	Hand Pulls	Harvesting	RUAs*	Draw Down	Chemical
1999							
Contoocook Lake, Rindge			X				X
Lake Monomonac, Rindge		X	X				X
Lake Winnepesaukee, Meredith Yacht Club, Meredith							X
Lake Winnepesaukee, Mt. View Marina, Gilford							X
Lake Winnepesaukee, Krainewood Shores, Moultonboro			X				X
Lake Winnepesaukee, West Alton Marine, Alton							X
Lake Winnepesaukee, Lake Shore Park							X
Captains Pond, Salem							X
Crescent Lake, Wolfeboro							X
Lake Wentworth, Wolfeboro		X	X				X
Northwood Lake, Northwood			X			X	
Lake Massasecum, Bradford	X	X	X	X	X		
Lake Massabesic, Auburn		X	X		X		
Totals:	1	4	7	1	2	1	10
2000							
Lake Winnepesaukee, Meredith Nautical Club, Meredith			X				X
Lake Winnepesaukee, Lake Shore Park, Gilford							X
Lake Winnepesaukee, Hemlock Harbor, Center Harbor							X
Lake Winnepesaukee, Arcadia Campground, Moultonboro							X
Lake Winnepesaukee, Meredith Bay/Fish Cove							X
Lake Winnepesaukee, West Alton Marine, Alton		X					X
Lake Winnepesaukee, Meredith/Round Cove			X				X
Northwood Lake, Northwood			X		X	X	X
Locke Lake, Barnstead							X
Lake Monomonac, Rindge		X	X				X
Contoocook Lake, Rindge			X				X
Lake Massasecum, Bradford	X	X	X	X	X		
Squam Lake, Holderness/Ashland		X	X		X		

Waterbody/Town	Innovative	Benthic Barriers	Hand Pulls	Harvesting	RUAs*	Draw Down	Chemical
Lake Massabesic, Auburn		X			X		
UNH Research: Property Value Research	X						
Winnepesaukee River, Tilton		X	x				
Totals:	2	6	8	1	4	1	11
2001							
Belleau Lake, Wakefield			X				X
Captain Pond, Salem							X
Horseshoe Pond, Merrimack							X
Lees Pond, Moultonborough							X
Lake Monomonac, Rindge							X
Rocky Pond, Gilmanton							X
Lake Sunapee	X						
Sunrise Lake, Middleton							X
Winnepesaukee River, Tilton		X					X
Lake Winnepesaukee, Ambrose Cove							X
Lake Winnepesaukee, Balmoral							X
Lake Winnepesaukee, Hemlock cove, Moultonborough							X
Lake Winnepesaukee, Island Marine, West Alton							X
Lake Winnepesaukee, Krainewood Shores, Center Harbor							X
Lake Winnepesaukee, Lake Shore Park, Gilford							X
Lake Winnepesaukee, Stanyen Road, Center Harbor							X
Lake Winnepesaukee, West Alton Marine, West Alton							X
Lake Winnisquam, Winnisquam							X
Lake Winnisquam, Split Rock, Meredith							X
Lake Winnisquam, Sunray Shores, Belmont							X
Lake Winnisquam, Torpely, Tilton							X
Lake Massasecum, Bradford	X	X	X	X	X		
Squam Lake, Holderness		X	X		X		
Dublin Lake, Dublin		X	X				
Lake Sunapee, Sunapee		X	X		X		
Lake Massabesic, Auburn					X		
Totals:	2	5	5	1	4	0	20

2.3.1 Restricted Use Areas

Restricted Use Areas (RUAs) are now a regular control option for lakes with small, contained infestations of exotics plants, limited to small patches or embayments. This is often the case in waterbodies with newly discovered infestations. RUAs restrict access to all recreational activities to minimize plant fragmentation and thereby reduce the spread of milfoil. As an additional method of protection from fragment migration, RUAs are equipped with a shallow net that is suspended vertically in the water column. The nets are approximately 1.5-2.0 feet in height. The top of the net is set to extend four inches above the surface of the water, while the remainder of the net is positioned below the surface of the water (see Figure 2-1 below). This configuration has been successful in preventing the movement of fragments from infested areas of waterbodies to uninfested areas.

Figure 2-1: Schematic of Restricted Use Area Net



Lake Massasecum, Bradford

An RUA has been placed in Lake Massasecum, Bradford, for the last four years. An infestation of variable milfoil covering approximately 10 acres of the northern cove has been successfully contained since the RUA has been in place. The netting continuously traps floating fragments of the plant. Volunteers regularly clean milfoil fragments from the net.

Lake Massabesic, Manchester

Lake Massabesic has been using RUAs for several years now. As this is a public water supply, herbicides are not an option in the control of variable milfoil. Because the lake receives high levels of transient boat traffic, Manchester Water Works maintains three RUAs on the lake; one near Deer Neck Bridge (Route 28), and two near Claire's Landing in Auburn.

Squam Lake, Holderness

An RUA was established at the mouth of the channel connecting Kimball Marine to Little Squam Lake. Kimball Marine is infested with variable milfoil, and due to water currents and boat traffic, fragments of milfoil were migrating into the main body of the lake. To prevent this transport of fragments, an RUA was established to trap fragments

and contain them within the marina.

Lake Sunapee, Sunapee

An RUA was established in the back cove of Georges Mill to contain milfoil to the infested cove of the lake. The RUA functions to limit boating activities in the area that is infested with variable milfoil.

In 2001, the Exotic Aquatic Species Program amended a rule to allow RUAs to be installed in areas where existing infestations can be found, but where they are small and isolated. Previous regulations allowed for RUA establishment only in areas that had 'limited new infestations'.

2.3.2 Hand-pulling

When infestations of exotic aquatic plants begin as single scattered stems or small patches, NHDES biologists SCUBA dive to hand-pull the plants. This control practice has proven successful in many waterbodies in the program's history. Most notably from 1999-2001 are the infestations of milfoil species found in Dublin Lake in Dublin (variable milfoil), and Lake Mascoma in Enfield (Eurasian milfoil). Both lakes had single stems of the plants in scattered locations close to shore. NHDES divers were able to head off a large-scale infestation by periodically diving and hand-pulling the plants as they appeared.

Typically, once detected, hand-pulling activities are conducted several times during the first season, with follow-up inspections for the next 1-2 years or until control is achieved.

2.3.3 Benthic Barriers

When a small infestation of exotic aquatic plants occurs in clusters of growth, as opposed to scattered stems, NHDES will place a permeable fiberglass screen over the area of infested lake sediments. Benthic barriers can effectively control small (less than 1000 square feet) infestations. The permeable fabric screening allows for gas release from the sediments while effectively blocking sunlight and compressing the plants to the sediment, thereby inhibiting photosynthesis and eventually killing the plant.

In recent years, benthic barriers were placed in several areas, including Lake Sunapee at Georges Mill, in Kimball Marina on Squam Lake, Dublin Lake in Dublin, Lake Massabesic in Auburn, and Lake Massasecum in Bradford. In each of these cases NHDES biologists continually monitored these sites to ensure that billowing of the barrier did not occur (occasionally in some lakes gas release from the sediments or boating activity causes uplifting of the screening).

2.3.4 Dredging

Dredging is a technique that is not often used to control exotic aquatic plants in New Hampshire, primarily due to the high cost of this control practice. Additionally, milfoil and other exotic plants tend to quickly colonize areas that are dredged. If a dredge does

not completely remove all plant fragments from the lake, the area will be quickly re-colonized, thereby negating the effort of the dredge.

Dredging has been used one time in exotic aquatic plant control in New Hampshire. Milville Lake in Salem was dredged in the mid 1980s to remove an infestation of exotic fanwort. The dredge was successful, and to date fanwort has not re-infested the lake.

A dredge was proposed for Flints Pond in Hollis in 2000 to remove an infestation of variable milfoil and to deepen the pond's maximum depth to below the photic zone. Due to a high level of arsenic in the lake sediments the dredge was cancelled due to concerns about the dredge spoils.

2.3.5 Targeted Application of Herbicides

Herbicide applications are conducted each year at the request of lake associations and municipalities. Herbicides offer 1-3 years of control for exotic aquatic plants. All herbicide applications are performed under permits issued by the NH Department of Agriculture.

In New Hampshire, two herbicides have been used for the control of variable milfoil. Herbicides have not been used for control of other exotic aquatic species. The most often used herbicide, Diquat, acts as a contact herbicide and can provide 1-2 seasons of control for milfoil. Because this herbicide does not target the root systems, the plants eventually re-sprout. The second herbicide, 2,4-D, is a systemic herbicide. It is absorbed into the sediments and taken up through the rooting systems of the plants, targeting both the root and the plant biomass above the sediments. Label restrictions for aquatic application currently limit its use in New Hampshire (reference Table 2-5 for a list of the targeted herbicide applications conducted from 1999-2001).

2.3.6 Extended Drawdown

Drawdowns have been used in the past as a cost effective means of plant control. The theory behind this practice is that the drying of the plants in the summer, or the freezing of the plants in the winter, will eliminate or thin nuisance growths of plants. Extended drawdowns are not very effective, as milfoil often forms a more succulent terrestrial form during drawdown conditions and the succulent form of the plant can remain viable for long periods of time without water.

This control technique has not been widely used to manage growths of exotic aquatic plants in New Hampshire. During the history of the Exotic Aquatic Species Program, controlled drawdown has been used successfully at only one lake, Mountain Pond in Brookfield. In the 1980s, the pond was heavily infested with Eurasian milfoil. It was drawn down and left empty for three full years to expose the plant to the elements. Following the three years the NHDES Dam Bureau rebuilt the outlet structure on the pond to raise the water level. Surveys in the late 1990s have shown no re-growth of the Eurasian milfoil.

Because most waterbodies cannot be drawn down for such extended periods without other negative environmental impacts, this control technique has not been routinely used to manage growths of exotic aquatic plants in New Hampshire.

2.4 Research

Initiating and participating in research activities is a key element in the Exotic Aquatic Species Program. As variable milfoil is not a nuisance species throughout the United States, little research has been conducted on the plants biology, ecological relationships, and potential control strategies. By working with local colleges and universities, as well as field testing various hypotheses on New Hampshire waterbodies, NHDES is able to make headway at finding viable solutions to existing infestations of this plant, as well as more effective mechanisms of prevention.

NHDES has already completed a research partnership with the University of New Hampshire to conduct an analysis of the impacts to property values caused by infestations of exotic aquatic plants like milfoil. Numerous waterbodies were examined throughout the state that had, or did not have, infestations of variable milfoil. Researchers found that lakes with infestations of variable milfoil were likely to suffer declines of nearly 16% in property values.

New research opportunities in the realm of genetic control and biological control are currently being considered by NHDES. As these opportunities evolve NHDES will continue to partner with state colleges and universities to carry out the research. Dartmouth College has already agreed to conduct research on the DNA gene sequencing for the milfoil species in New Hampshire.

2.5 Regional Cooperation

One of the goals of working on a regional level is to standardize the key legislation and education initiatives between the New England states. To date, only New Hampshire, Vermont and Maine have exotic species legislation in New England. Other states are becoming interested in creating programs and legislation. Prohibition of exotic species sale and transport is much more effective on a regional basis than state-by-state. If a standardized list of exotic plants can be listed as prohibited in New England and neighboring states, the likelihood of success in preventing the spread of these species to new waterbodies is increased.

New Hampshire's Exotic Aquatic Species Program Coordinator has also attended various planning meetings in other states, at their request, to assist in developing exotics legislation, programs and Weed Watcher activities.

NHDES staff provided assistance to the Maine Department of Environmental Protection and various lake associations in formulating new exotic species legislation in 1999. NHDES provided guidance and examples of our legislation and regulations for Maine to utilize in drafting their legislation. NHDES also assisted Maine DEP in draft reviews and writing letters of support for the effort. Today, Maine has very similar legislation to New Hampshire, and has even taken more stringent actions in preventing

transportation and introduction of exotic plants by targeting out-of- state boaters and imposing hefty fines for violating exotic species laws. New Hampshire is closely monitoring the progress of this program for potential implementation in this state in the future.

In the fall of 2000, the Exotics Coordinator was also invited to present a workshop on exotic aquatic species and Weed Watching at the annual meeting of the Pennsylvania Lake Management Society. Pennsylvania still does not have exotic species legislation in place, but has been exploring the potential for establishing a program similar to New Hampshire's. The meeting was comprised of lake association members, private consultants, state employees, and legislators from Pennsylvania. The Exotics coordinator provided guidance and resources for creating appropriate legislation and establishing a volunteer Weed Watcher Program.

In an effort to promote the efforts of New Hampshire's Exotic Aquatic Species Program, and to assist neighboring states, numerous copies of New Hampshire exotic aquatic species legislation and regulations were mailed to several northeastern states, including Rhode Island, Connecticut, and New York to assist these states with the development of similar programs.

Additionally, in an effort to promote further cooperation among the New England States, New Hampshire is active in various professional organizations associated with exotic species control and outreach activities. Goals of these organizations include fostering partnerships between states to reduce the transport of exotic plants, sharing success and failure information with regards to control practices, and strategizing to enhance existing programs and legislation to reduce the impacts of invasive plants. Following is a list of organizations with which NHDES is involved:

- **Northeast Aquatic Plant Management Society (NEAPMS)-** This organization is represented by state and regional government officials, academia, and plant management specialists. The goal of the group is to share resources and information about management practices and innovative technologies, as well as to provide a forum for interaction between government, academia, and managers.
- **North American Lake Management Society (NALMS)-** This organization focuses on a variety of lake management issues, including a focus on exotic plant management and impacts to lake ecology as a result of exotic aquatic plant infestation. This organization is represented by state, federal, and regional government officials, academia, professional research organizations, and miscellaneous non-government officials and organizations. This group meets once annually.
- **NH Invasive Species Committee-** This committee was established by legislation enacted by the Department of Agriculture. This committee is comprised of one representative from each state agency, one representative

from academia, one from the nursery industry, and three members at large from the public. The group is charged with developing a list of prohibited species in New Hampshire, finding ways to enforce compliance with listed species, and developing education and outreach materials for target audiences that are affected by the list. This group meets on a monthly basis in Concord, NH.

- **Northeast Invasive Plant Group (NIPGRO)-** NIPGRO is an organization established by the US Fish and Wildlife Service to protect the resources of the Connecticut River and its watershed. The group focuses on both terrestrial and aquatic plants that are non-native invasive species in the states bordering the river system. The group supports the development of a region wide plant atlas, the development of educational materials pertaining to each invasive species, and the sharing of information between the states. This group meets once annually, and hosts an informational 'share fair' once every three years.
- **Northeast Aquatic Nuisance Species Task Force (NEANSTF)-** This group is a regional chapter of the National Aquatic Nuisance Species Task Force. The group was organized in December of 2001, so it is still in its formative phases. The goals of this group are to assist the northeastern states and Canadian provinces in developing state and regional Aquatic Nuisance Species Management Plans. There is a federal initiative to have each state develop its own management plan and submit it to the regional chapters for initial review, with subsequent filing with the national Task Force. The purpose of these management plans is to have states develop strategies for dealing with existing and potential infestations of exotic aquatic plants and animals that pose a threat to its water resources. Once a state has a developed plan the likelihood of federal technical and financial assistance is increased. The group is represented by state agencies across the northeast. The group plans to meet twice annually.

3. PROGRAM COSTS

Beginning in 1981, exotic plant control activities were funded by a \$0.50 fee added to boat registrations. Then, in 1998, the legislature established the Lake Restoration and Preservation Fund and a fee of \$1.50 per boat registration was deposited to the fund for the Exotic Aquatic Species Program. Table 3-1 summarizes the income and expenditures for the four years that this dedicated fund has been in place.

Table 3-1
Program Income and Expenditures for 1998-2001

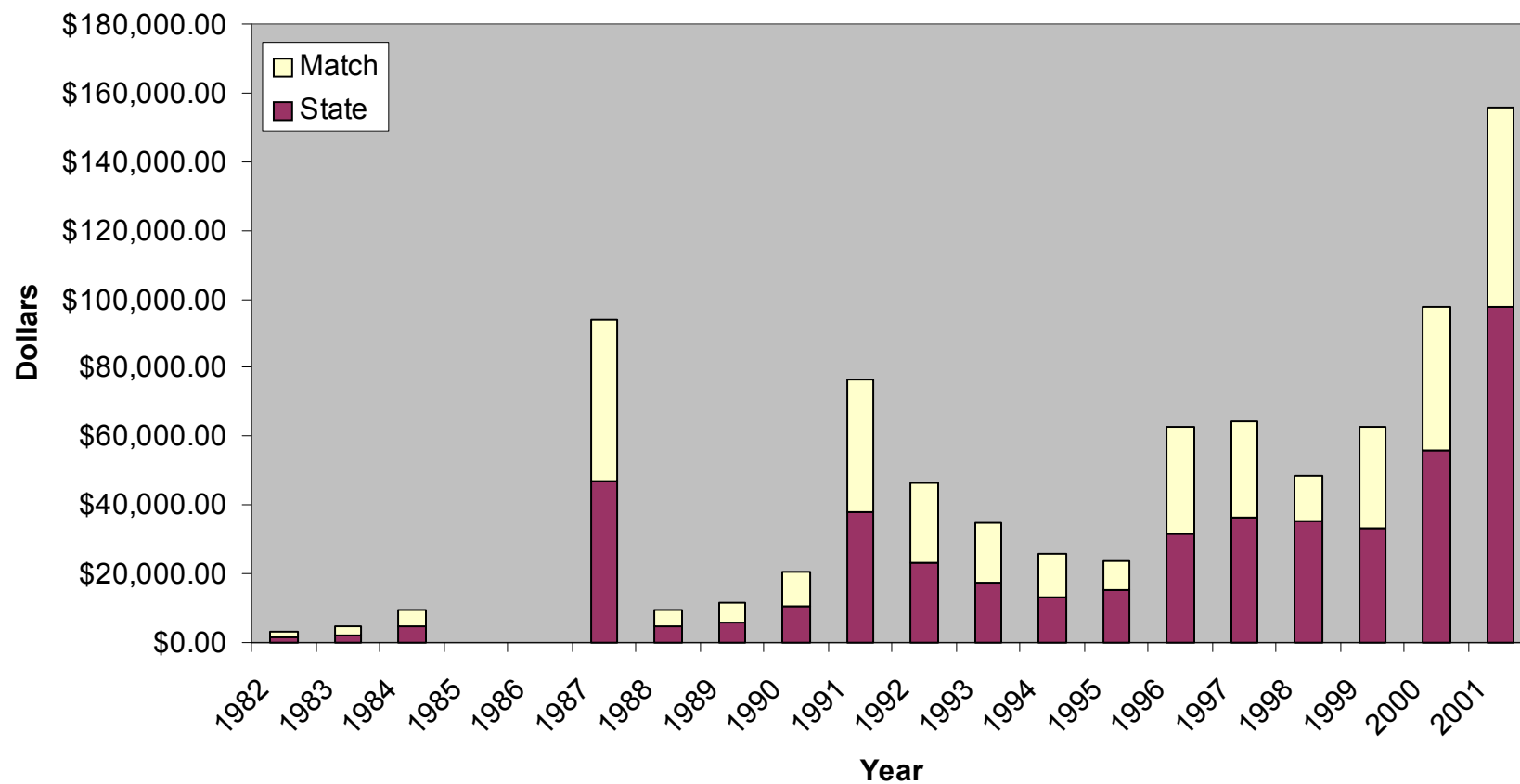
FISCAL YEAR	INCOME	EXPENSE
1998	\$ 97,059.00	\$ 39,826.00
1999	\$130,467.00	\$ 97,818.00
2000	\$169,832.00	\$129,084.00
2001	\$146,711.00	\$181,999.00

Approximately 50% of annual expenses are for control measures, with the rest allocated to education and outreach. The fund pays 100% of the control costs for new infestations, 50% of the cost for subsequent control practices, and 80% of the costs for innovative control measures, with the remaining costs paid by local organizations, municipalities, or individuals. Figure 3-1 illustrates the NHDES expenditures for exotic plant control grants, and matching grants from municipalities and lake associations for each year of the program. In FY 2001, the largest amount of money in the program's history was expended for grants to local organizations for control practices.

Grants for innovative milfoil control activities are made to lake associations that work with NHDES to develop a new or innovative control practice on their own. For example, since 1999 the Lake Massasecum Improvement Association (LMIA) in Bradford, New Hampshire has been receiving annual grants for innovative practices. The LMIA developed a net configuration to attach to established RUAs to prevent milfoil fragments from being transported through drift and wind action. In addition, the LMIA developed a pontoon boat harvester to continuously harvest the milfoil in their lake during the summers. It is thought that constant harvesting will inhibit the ability of the plants to photosynthesize and save their energy to the rooting systems for the winter. If this ability is restricted then the plants may weaken and die. At the end of the summer of 2001, the milfoil plants in the lake were much reduced. We will continue to monitor this site to determine the overall success of this innovative strategy.

More organizations are beginning to take interest in innovative control practices. During 2001, six grant applications for innovative control or prevention practices were received, of which three were funded.

Annual Expenditures for Exotic Aquatic Plant Control Activities



Note: Data from NHDES Exotic Aquatic Species Program, 2001

4. THE FUTURE

The goals of the Exotic Aquatic Species Program are to limit the further spread of exotic aquatic species, control new and existing infestations, and to research new ways to contain or even reverse the spread of these species. Objectives in the five focus areas are:

Education and Outreach: Foster increased partnerships among public and private lake associations, state agencies, regional groups, and other aquatic interests to provide and disseminate innovative and proactive educational materials that inform the public about exotic aquatic species, how they are spread, and how they are controlled.

Monitoring for Early Detection: Expand the Weed Watcher Program and coordinate training activities with volunteer monitors. Map infestations using global positioning systems to more accurately document and track the occurrence and distribution of infestations over time. Develop DNA gene sequencing methods for positive identification of variable milfoil during all life stages.

Control: Develop a streamlined process, including appropriate monitoring and environmental assessment, for conducting herbicide applications.

Research: Conduct research on long-term control methods and potential means for eradication of exotic aquatic plants. With Dartmouth College, develop DNA gene sequencing methods for positive identification of variable milfoil during all life stages. With the University of New Hampshire, conduct further research on the impact of exotic plant infestations on lakefront property values.

Regional Cooperation: Foster partnerships with other states across the northeast region to better promote an understanding of exotic aquatic species and their impacts on our water resources. Assist other states in developing and/or enhancing exotic species legislation.

Looking to 2002 and beyond, we would like the program to grow to meet the challenge of preventing new exotics infestations, controlling existing ones, and researching new techniques for control and even eradication of exotic aquatic species. There is much to be done. Although we see growing resources available to combat exotic species, we also see the increased spread of exotics to new waterbodies. We expect the recent dramatic increase in requests for exotic species control grants to continue, spurred by increased public awareness and interest.

This year the New Hampshire Lakes Association (NHLA) has partnered with the program to secure federal funding in 2002 for enhanced education and outreach, as well as grants to local organizations for boat launch monitoring. Additionally, in its 2002 session, the New Hampshire General Court is considering legislation that would substantially increase funding and program capability for boat launch monitoring and exotics research.

The sections below summarize a vision for program activities in FY 2002 and 2003.

4.1 Education and Outreach

- ❖ In partnership with NHLA, produce a colored poster depicting the fourteen prohibited exotic aquatic species, distribute it free to the public and post it at boat launches, marinas, state and local offices
- ❖ In partnership with NHLA, publish a full color identification booklet for native and common plants in New Hampshire, including colored photos, line drawings, and written descriptions of the plant and its habitat and distribute it free or at cost to Weed Watchers and VLAP organizations
- ❖ In partnership with NHLA, produce a video on exotic plants in New Hampshire and make it available to lake associations, towns, and others interested in exotic aquatic plants.
- ❖ Perform radio and television public service announcements (PSAs) on exotics during the boating season
- ❖ Develop and publish a “Weed Watchers” newsletter beginning in 2002, and annually thereafter
- ❖ Produce a Weed Watcher baseball cap to thank volunteers for their efforts and to identify them as volunteers
- ❖ Update fact sheets and educational materials for distribution to the public
- ❖ Produce an annual poster or calendar depicting the exotic aquatic plants that are problematic in New Hampshire
- ❖ Conduct plant identification and Weed Watcher workshops in conjunction with the annual Volunteer Lake Assessment Program ‘Refresher Workshop.

4.2 Monitoring and Identification

- ❖ Train additional volunteer Weed Watchers to locate new exotic plant infestations earlier in the growing season
- ❖ Train VLAP volunteers in both native and exotic aquatic plant identification
- ❖ Locate and map individual infested areas of exotic aquatic plants, using GPS, and develop a process to track size and location of infested areas over time.
- ❖ Assist the Pesticide Control Board of the Department of Agriculture with aquatic herbicide permits and evaluations
- ❖ Conduct 30-40 lake macrophyte surveys each summer in 2002 and 2003

4.3 Control

- ❖ Develop an application process for exotic species control grants, including an RFP and timelines that encourage permit application submittal by early fall of each year
- ❖ Document decisions for control techniques in accordance with the “Criteria to Evaluate the Selection of Aquatic Control Techniques” (See Appendix 5)
- ❖ Educate applicators to the necessary application requirement to aid permit review by the Pesticide Control Board

4.4 Research

- ❖ Explore ways to increase funding for research on invasive plants
- ❖ Partner with state colleges and universities to conduct biological and ecological research on variable milfoil
- ❖ Partner with Dartmouth College to conduct genetic research on variable milfoil to ultimately develop a gene sequencing method for rapid identification of exotic milfoil when it is not in flower
- ❖ Partner with state colleges and universities to research development of genetic or biological control of variable milfoil
- ❖ Work with UNH to publish results of study on impacts to property values on lakes with invasive species

4.5 Regional Cooperation

- ❖ Attend invasive species conferences to keep up with current research methods, educational activities, and exotic aquatic species programs
- ❖ Give presentations on New Hampshire's programs to impart information on both the successes and needs for improvement in the various categories within the Exotic Aquatic Species Program
- ❖ Assist the State of Connecticut in promoting and drafting exotics legislation by giving a presentation to appropriate legislative committees, if asked, and providing copies of New Hampshire's legislation and annual reports
- ❖ Assist the State of Pennsylvania in promoting and drafting legislation and monitoring programs for exotic aquatic plants by providing copies of New Hampshire legislation, fact sheets, and Weed Watcher materials
- ❖ Continue to actively participate in regional groups and organizations to expand resources and the knowledge base for New Hampshire's program

References

Halstead, J.M., J. Michaud, S. Hallas-Burt, and J.P. Gibbs. 2001. An Hedonic Analysis of the Effects of an Exotic Invader (*Myriophyllum heterophyllum*) on New Hampshire Lakefront Properties. University of New Hampshire, Durham.

Appendix One

NHDES Exotic Aquatic Species Program

Clean Lakes Statutes RSA 487:15-RSA 487:25
and

Chapter Env-Ws 1300 of NH Administrative Rules

CHAPTER 487 **Control of Marine Pollution and Aquatic Growth**

New Hampshire Clean Lakes Program

§ 487:15 Purpose. – The general court recognizes that rapidly escalating pressures of shorefront development and recreational uses of public waters have placed increasing strains upon the state's lake resources, thereby accelerating the eutrophication process in many of our public lakes through nuisance growths of aquatic macrophyton and phytoplankton (algae) and thus posing a threat to water quality. The general court further recognizes the need to restore, preserve and maintain the state's lakes and ponds in order that these significant environmental, aesthetic and recreational assets will continue to benefit the social and economic well-being of the state's citizens.

Source. 1990, 143:2, eff. June 18, 1990.

§ 487:16 Definitions. – In this subdivision:

I. "Department" means the department of environmental services.

II. The term "exotic aquatic weeds" includes only those species of vascular aquatic plants which were not part of New Hampshire's native aquatic flora before 1950. *Cabomba caroliniana* and *Myriophyllum heterophyllum* are examples of exotic aquatic weeds.

III. "Federal program" means the federal Water Pollution Control Act, 33 U.S.C.A. 1324, the federal clean lakes program (P.L. 92-500, section 314), as amended, now known as the Water Quality Act of 1987 (P.L. 100-4), as amended.

IV. "Commissioner" means the commissioner of the department of environmental services.

Source. 1990, 143:2, eff. June 18, 1990. 1996, 228:98, 99, eff. July 1, 1996. 1997, 185:2, eff. Jan. 1, 1998.

§ 487:16-a Exotic Aquatic Weed Prohibition. – No exotic aquatic weeds shall be offered for sale, distributed, sold, imported, purchased, propagated, transported, or introduced in the state. The commissioner may exempt any exotic aquatic weed from any of the prohibitions of this section consistent with the purpose of this subdivision.

Source. 1997, 185:3, eff. Jan. 1, 1998.

§ 487:16-b Exotic Aquatic Weed Penalties. –It shall be unlawful to knowingly, recklessly, or purposely offer for sale, distribute, sell, import, purchase, propagate, or

introduce exotic aquatic weeds into New Hampshire waterbodies. Notwithstanding RSA 487:7, any person engaging in such an activity shall be guilty of a violation.

Source. 1999, 204:3, eff. Jan. 1, 2000.

§ 487:17 Program Established. – I. A program for the preservation and restoration of New Hampshire lakes and ponds eligible under RSA 487:20 shall be established and administered within the department of environmental services. Said program shall function to limit the eutrophication process in New Hampshire lakes by reducing nuisance growths of macrophyton and phytoplankton. It shall reinforce and complement the program authorized by the federal program and shall serve 3 basic purposes:

(a) To diagnose degraded lakes and ponds and implement long-term solutions for the purpose of restoring water quality where such solutions are feasible and cost effective.

(b) To diagnose lakes and ponds and implement methods for long-term preservation of the water quality when such measures can be shown to be feasible and cost effective.

(c) To provide short-term remedial actions which can effectively maintain water quality conditions adequate for public recreation and enjoyment, including, but not limited to, the control of exotic aquatic weeds pursuant to paragraphs II and III.

II. The department is directed to prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state. The department is authorized to:

(a) Display and distribute promotional material and engage in educational efforts informing boaters of the problems with exotic aquatic weed control.

(b) Eradicate small new infestations of exotic aquatic weeds, according to the following criteria:

(1) The waterbody had been free, within the previous 5 years, of the exotic aquatic weed to be treated.

(2) The infestation is not widespread in the waterbody, and the department shall have determined that the exotic aquatic weed can in fact be eradicated from the waterbody.

(3) The most environmentally sound treatment technique relative to the specific infestation will be used, which also meets the requirements of state rules, including rules adopted under RSA 430.

(c) Develop an emergency response protocol to eradicate small new infestations. The protocol may include contractual agreements with one or more licensed pesticide

applicators that would enable the prompt treatment of exotic aquatic weeds with herbicides consistent with the criteria provided in subparagraph (b).

(d) Designate, in consultation with the department of fish and game and the division of safety services, department of safety, restricted use of exotic aquatic weed control areas.

III. After notice and opportunity for hearing and comment, the department may make financial grants to lakefront associations, private businesses, citizens, and local governmental agencies for the management of exotic aquatic weeds where eradication is deemed impossible. All applications for grants by such groups shall be approved by both the department and the fish and game department, and shall meet state rule requirements.

Source. 1990, 143:2, eff. June 18, 1990. 1996, 228:100, 106, eff. July 1, 1996. 1997, 185:4, eff. Jan. 1, 1998.

§ 487:18 Project Prioritization. – Project approval shall be based upon prioritization factors to be established by rules adopted under RSA 541-A. Such rules shall give first priority for expenditure of available funds to the eradication of new infestations of exotic aquatic weeds pursuant to RSA 487:17, II(b) and second priority to all reasonable measures to control exotic aquatic weeds. Otherwise, preference shall be given to lakes that have public access or that serve as a public drinking water supply. Implementation measures shall be based upon an assessment of potential success, technical feasibility, practicability, and cost effectiveness. Restoration and preservation projects shall include watershed management plans to control and reduce incoming nutrients wherever possible through best management practices. Repeated short-term solutions shall be discouraged where long-term solutions are feasible and cost effective. Treatments shall be designed to minimize any adverse effect upon fish and wildlife, their habitats, and the environment.

Source. 1990, 143:2, eff. June 18, 1990.

§ 487:19 Public Hearings. – No project for the implementation of a lakes restoration or preservation program shall be approved or initiated until at least 2 public hearings have been held on the project. Said hearings shall be held in one or more of the affected municipalities.

Source. 1990, 143:3, eff. June 18, 1990.

§ 487:20 Eligibility. – To be eligible for funding under this subdivision, a body of water shall be any freshwater lake or pond which meets priorities established under RSA 487:18. Lakefront associations, private businesses, citizens and local government agencies shall be eligible to apply for funding under this subdivision.

Source. 1990, 143:3, eff. June 18, 1990.

§ 487:21 Cost Sharing. – I. For diagnostic and feasibility studies where the federal government has made financial assistance available in the amount of 70 percent of the cost, the department may provide an amount not exceeding 30 percent of the total eligible costs as determined by the department. Where no federal funding is available, the department may provide an amount not exceeding 80 percent of the total eligible costs.

II. For implementation of restoration or preservation projects where the federal government has made financial assistance available in the amount of 50 percent of the costs, the department may provide an amount not exceeding 35 percent of the total eligible costs, as determined by the department. Where no federal funding is available, the department may provide an amount not exceeding 80 percent of the total eligible costs.

III. For water quality maintenance programs, the department may provide an amount of funding not to exceed 80 percent of the total eligible costs, as determined by the department, except that for the eradication of new infestations of exotic aquatic weeds the state may assume 100 percent of the cost.

IV. The local cost share shall be the cost of a project remaining after taking into account any state and federal funding.

V. An amount up to 10 percent of the total available funding may be expended on research that addresses the problems of lake eutrophication and exotic aquatic weeds.

Source. 1990, 143:3, eff. June 18, 1990. 1996, 228:106, eff. July 1, 1996.

§ 487:22 Municipal Agreements. – Whenever a project requires a commitment of cooperative action or local cost sharing involving 2 or more municipalities, all participating municipalities shall execute an intermunicipal agreement relative to their respective obligations. No project which requires a local match shall be initiated with state funding until such an agreement, if applicable, has been approved by the legislative bodies of all the involved municipalities.

Source. 1990, 143:3, eff. June 18, 1990.

§ 487:23 Agency Cooperation. – The department shall make a concerted effort to integrate and coordinate the clean lakes program with other environmental management programs involving lakes and their watersheds, whether such programs fall within the jurisdiction of the department of environmental services or within that of another state department. The university system and the department shall maintain regular communication for the purpose of sharing data bases and other relevant information.

Source. 1990, 143:3, eff. June 18, 1990. 1996, 228:101, eff. July 1, 1996.

§ 487:24 Rulemaking. – The commissioner shall adopt rules, under RSA 541-A, relative to:

I. The criteria to be used in the prioritization of grants for diagnostic or feasibility studies.

II. The criteria used to determine the priority of implementation projects and maintenance projects.

III. Contracting procedures with local governments or private businesses.

IV. Application procedures to participate in the program.

V. Criteria for the determination of project eligibility.

VI. Criteria governing the conduct of and reporting requirements on diagnostic and feasibility studies, implementation projects and maintenance projects.

VII. Designation of plants as exotic aquatic weeds as defined in RSA 487:16, II.

VII-a. Administration and enforcement of, and exemptions to, the exotic aquatic weed prohibition under RSA 487:16-a.

VII-b. Criteria governing the emergency response protocol under RSA 487:17, II(c).

VII-c. Designation of restricted use exotic aquatic weed control areas under RSA 487:17, II(d).

VIII. Any other matters that are necessary to implement the provisions of this subdivision.

Source. 1990, 143:3, eff. June 18, 1990. 1997, 185:5, eff. Jan. 1, 1998.

§ 487:25 Lake Restoration and Preservation Fund; Addition to Boat Fee. – I. An additional fee of \$2 to those already collected under the provisions of RSA 270-E:5 for each private boat registered shall be paid to the director of the division of motor vehicles. The director of the division of motor vehicles shall pay over said additional fees to the state treasurer who shall keep said fees in a special fund to be expended by the department of environmental services. The department shall use \$.50 of the fee for lake restoration and preservation measures, exclusive of exotic aquatic weed control, and \$1.50 of the fee for the control of exotic aquatic weeds. The special fund shall be nonlapsing. All funds received under this section are continually appropriated to the department for the purposes of this subdivision.

II. The department is authorized to utilize such methods of control and to employ such personnel, consultant services, and equipment as, in its judgment, will control aquatic nuisances in the surface waters of the state as defined in RSA 485-A:2.

III. The department shall be the agency to receive and utilize federal funds, gifts, or grants from any person or association, which may be made available for the purposes of this subdivision.

Source. 1990, 143:3, eff. June 18, 1990. 1996, 228:102, 106, eff. July 1, 1996. 1997, 185:6, eff. Jan. 1, 1998.

ADMINISTRATIVE RULES

CHAPTER Env-Ws 1300 EXOTIC AQUATIC WEED CONTROL

Statutory Authority: RSA 487:24, VII-a, VII-b, and VII-c

PART Env-Ws 1301 PURPOSE AND APPLICABILITY

Env-Ws 1301.01 Purpose. The purpose of these rules is to implement RSA 487:16-a, which prohibits the sale, distribution, importation, purchase, propagation, transportation, or introduction into the state of exotic aquatic weeds, and RSA 487:17, II (d) relative to the designation of control areas for exotic aquatic weeds.

Source. #6852 eff 9-5-98

Env-Ws 1301.02 Applicability. These rules shall apply to people who live, work, and recreate on the lakes of New Hampshire, as well as people who own stores that sell exotic aquatic weeds.

Source. #6852 eff 9-5-98

PART Env-Ws 1302 CHAPTER DEFINITIONS

Env-Ws 1302.01 "Bottom barrier" means a semi-permeable, fine mesh screening, laid over an area of sediments in a lake to shade and physically inhibit plant growth.

Source. #6852 eff 9-5-98

Env-Ws 1302.02 "Commissioner" means the commissioner of the department of environmental services.

Source. #6852 eff 9-5-98

Env-Ws 1302.03 "Cultivar" means a cultivated species of plant for which there is no wild form.

Source. #6852 eff 9-5-98

Env-Ws 1302.04 "Department" means the department of environmental services.

Source. #6852 eff 9-5-98

Env-Ws 1302.05 "Exotic aquatic weeds" means "exotic aquatic weeds" as defined by RSA 487:16, II, namely "only those species of vascular aquatic plants which were not part of New Hampshire's native aquatic flora before 1950. *Cabomba caroliniana* and *Myriophyllum heterophyllum* are examples of exotic aquatic weeds."

Source. #6852 eff 9-5-98

Env-Ws 1302.06 "Herbaria" means collections of dried, pressed plants for the purposes of education and scientific study.

Source. #6852 eff 9-5-98

Env-Ws 1302.07 "Infested waters" means water and water bodies having populations of prohibited exotic aquatic weeds such as milfoil or fanwort.

Source. #6852 eff 9-5-98

Env-Ws 1302.08 "Limited infestations" means an infestation of 5 acres or less.

Source. #6852 eff 9-5-98

Env-Ws 1302.09 "Maintenance project" means the short-term control of an infestation of exotic aquatic weeds by treating the weeds directly rather than treating the cause of the infestation.

Source. #6852 eff 9-5-98

Env-Ws 1302.10 "New infestation" means an infestation that was not previously reported to the department.

Source. #6852 eff 9-5-98

Env-Ws 1302.11 "Restricted use area" means a marked area or marked areas of a water body where infestations of exotic aquatic weeds have been delineated in accordance with Env-Ws 1304, which is closed to entry by boaters, anglers, or other

water users and their equipment, except in emergency situations where property or human life is endangered.

Source. #6852 eff 9-5-98

Env-Ws 1302.12 "Surface waters of the state" means "surface waters of the state" as defined by RSA 485-A:2, XIV, namely, "streams, lakes, ponds and tidal waters within the jurisdiction of the state, including all streams, lakes or ponds bordering on the state, marshes, water courses and other bodies of water, natural or artificial."

Source. #6852 eff 9-5-98

PART Env-Ws 1303 PROHIBITED EXOTIC AQUATIC WEEDS AND EXEMPTIONS

Env-Ws 1303.01 Prohibitions and Designation. The following exotic aquatic weeds, identified in "A Manual of Aquatic Plants" by Norman C. Fassett and "Aquatic and Wetland Plants of Northeastern North America" by Garrett Crow and C. Barre Hellquist, both copyrighted by The University of Wisconsin Press, shall be prohibited from being offered for sale, distributed, sold, imported, purchased, propagated, transported or introduced in the state, pursuant to RSA 487:16-a, because they pose a substantial threat to native species in the state:

- (a) *Myriophyllum heterophyllum*, commonly referred to as variable milfoil;
- (b) *Myriophyllum spicatum*, commonly referred to as Eurasian milfoil;
- (c) *Cabomba caroliniana*, commonly referred to as fanwort;
- (d) *Hydrilla verticillata*;
- (e) *Trapa natans*, commonly referred to as water chestnut;
- (f) *Myriophyllum aquaticum*, commonly referred to as parrot-feather;
- (g) *Potamogeton crispus*, commonly referred to as curly leaf pondweed;
- (h) *Lythrum salicaria*, *L. virgatum*, *L. alatum* and their cultivars, commonly referred to as purple loosestrife;
- (i) *Phragmites australis* or *P. communis*, commonly referred to as common reed;
- (j) *Egeria densa*, commonly referred to as Brazilian elodea;
- (k) *Hydrocharis morsus-ranae*, commonly referred to as frogbit;

- (l) *Butomus umbellatus*, commonly referred to as flowering rush;
- (m) *Najas minor*, commonly referred to as European naiad; and
- (n) *Nymphoides peltata*, commonly referred to as yellow floating heart.

Source. #6852 eff 9-5-98

Env-Ws 1303.02 Exemptions for Transportation. Transportation of any exotic aquatic weeds on any road or highway in the state shall be exempt from the transportation prohibition of RSA 487:16-a, if the following are true:

- (a) It is for disposal as part of a harvest control activity under the supervision of the department;
- (b) It is for the purpose of identifying a species or reporting the presence of a species, and the exotic aquatic weed is in a sealed container; or
- (c) It will be disposed of after removal from recreational watercraft and equipment, such as trailers, motors, fishing equipment, or diving gear.

Source. #6852 eff 9-5-98

Env-Ws 1303.03 Acceptable Means of Disposal.

- (a) Any exotic aquatic weed shall be immediately disposed of away from water or moist areas where it might survive.
- (b) Acceptable means of disposal shall include but not be limited to:
 - (1) Burning;
 - (2) Land filling;
 - (3) Disposing in a trash container;
 - (4) Desiccating; and
 - (5) Composting, if applied away from surface waters.

Source. #6852 eff 9-5-98

Env-Ws 1303.04 Exemptions for Preserved Specimens. Pursuant to RSA 487:16-a, the prohibitions listed in Env-Ws 1301.01 shall not apply to exotic aquatic weeds in the form of herbaria or other preserved specimens.

Source. #6852 eff 9-5-98

Env-Ws 1303.05 Exemptions for Research or Education. Pursuant to RSA 487:16-a, the prohibitions listed in Env-Ws 1303.01 shall not apply to exotic aquatic weeds being used in a controlled environment, such as in a laboratory for research or for educational display.

Source. #6852 eff 9-5-98

Env-Ws 1303.06 Exemptions for Field Experimentation. Pursuant to 487:16-a, the prohibitions listed in Env-Ws 1303.01 shall not apply to remedial actions in the field for the purpose of finding control mechanisms involving exotic aquatic weeds, which, based on the proposed use and safeguards for containment, will minimize the risk of harm to natural resources or their use in the state.

Source. #6852 eff 9-5-98

Env-Ws 1303.07 Notification Requirement.

(a) Any person other than an employee of the department acting in his or her official capacity, who participates in any of the above exempted activities, Env-Ws 1303.02 and Env-Ws 1303.04 through Env-Ws 1303.06, shall notify the department prior to or within 24 hours after performing such activity, by calling 271-3503.

(b) Notification is not required for disposal after removal from recreational equipment pursuant to Env-Ws 1303.02(c) and Env-Ws 1303.03.

Source. #6852 eff 9-5-98

PART Env-Ws 1304 IDENTIFICATION, NOTICE, DE-LISTING AND MARKING OF RESTRICTED USE AREAS

Env-Ws 1304.01 Designation and De-listing of Restricted Use Areas.

(a) The commissioner, in consultation with the executive director of the fish and game department and the director of the safety services division of the department of safety, shall designate as a restricted use area any area that contains a new limited infestation of exotic aquatic weed(s).

(b) After designation, a restricted use area shall be in place until the area is no longer infested subject to the criteria in (a) above, or until a period of 3 years has expired since the time of designation.

(c) When an infestation has been eradicated or cannot be successfully treated or managed within the 3-year time limit, or the 3-year time limit has been reached, the

commissioner, in consultation with the executive director of the fish and game department and the director of the safety services division of the department of safety shall evaluate the designated site to determine whether they will de-list the restricted use area or extend the restriction on the area.

(d) The commissioner shall issue press releases to the newspapers in the towns surrounding the water body(ies) in which a restricted use area is designated or de-listed.

Source. #6852 eff 9-5-98

Env-Ws 1304.02 Notification Protocol. The commissioner, in consultation with the executive director of the fish and game department and the director of the safety services division of the department of safety, shall notify the public when a restricted use area has been designated or de-listed and when buoys are installed or removed.

Source. #6852 eff 9-5-98

Env-Ws 1304.03 Notice of Restricted Use Areas.

(a) The department shall post signs warning of a restricted use area in accordance with Env-Ws 1304.04.

(b) The commissioner shall publish the names of identified water bodies which contain restricted use areas in a press release.

(c) Notice shall include the following information:

(1) The town(s) in which the water body containing the restricted use area is located;

(2) The name of the water body containing the restricted use area;

(3) The specific location of the infestation within the water body;

(4) The type of infestation; and

(5) The general dimensions of the restricted use area.

Source. #6852 eff 9-5-98

Env-Ws 1304.04 Delineation and Markers for Restricted Use Areas. The department or its designee shall mark restricted use areas using buoys and signs as specified below:

(a) A minimum of 3 buoys and/or signs shall be used to delineate a restricted use area;

- (b) The buoys shall be placed not more than 300 feet apart;
- (c) The buoys shall be connected by rope with small floats every 8 feet;
- (d) At least 2 buoys and/or signs shall be placed at or near the shoreline to delineate a restricted use area if the area is adjacent to the shore; and
- (e) Buoys shall be removed at the end of each growing season, unless removed sooner pursuant to the de-listing process.

Source. #6852 eff 9-5-98

Env-Ws 1304.05 Type of Warning Buoy. The buoy which warns of a restricted use area shall:

- (a) Be a standard state danger buoy;
- (b) Be white and international orange in color;
- (c) Have an orange diamond symbol with an X through it; and
- (d) Read as follows: "Restricted Use Area, pursuant to RSA 487. NH Dept. of Environmental Services 603-271-3503."

Source. #6852 eff 9-5-98

Env-Ws 1304.06 Marking of Restricted Use Areas by Municipalities.

- (a) Any municipality with a similar method of marking restricted use areas within municipal water supplies may request the department to approve the method, in lieu of Env-Ws 1304.04, by submitting a request in writing to the department.
- (b) The department shall grant authorization to a municipality to mark municipal water supplies if the method of marking to be used by the municipality is equivalent or more stringent than the method identified in Env-Ws 1304.04.

Source. #6852 eff 9-5-98

Env-Ws 1304.07 Navigation Prohibition. Subject to Env-Ws 1304.08, no person or equipment, including boaters, anglers, or other water users, or private or commercial watercraft of any type, shall enter a restricted use area except in emergency situations where property or human life is endangered.

Source. #6852 eff 9-5-98

Env-Ws 1304.08 Lake Access. If an infestation occurs at an access point to a marina, private residence, or public or private access ramp, a bottom barrier shall be put over the infestation to keep it from spreading and the access point shall be left open.

Source. #6852 eff 9-5-98

Env-Ws 1304.09 Signs. The department shall post signs at marinas or public or private access sites notifying the public of restricted use areas and the signs shall:

- (a) Be at least 8 ½ by 11 inches in size; and
- (b) Read as follows: "This buoy marks a RESTRICTED USE AREA on this water body, designated pursuant to RSA 487:17. Please help prevent the spread of exotic aquatic plants by staying out of these areas."

Source. #6852 eff 9-5-98

PART Env-Ws 1305 MAINTENANCE AND REMOVAL OF BUOYS

Env-Ws 1305.01 Responsible Agency. The department shall maintain, inspect and remove buoys as follows:

- (a) The department shall install buoys during weekday office hours; and
- (b) The department shall remove the buoys at the end of each growing season, unless removed sooner pursuant to the de-listing process.

Source. #6852 eff 9-5-98

Appendix Two
NHDES Exotic Aquatic Species Program
Chronology of Key Events: 1981-2000

NHDES Exotic Aquatic Species Program Chronology of Events: 1981-1998

1981

- The exotic aquatic weed control legislation (RSA 487-17 formally RSA 149-F:3) became law on August 22, 1981.
- Fifty thousand brochures describing the exotic aquatic weed control program were distributed to boat license agents, state rest areas, marinas and lake associations.
- Waterproof posters depicting how to stop the spread of exotic weeds to other waterbodies were designed and distributed by DES personnel. Posters were placed at high use boat launching facilities throughout the state.
- A television commercial describing the exotic weed control program aired on Channel 9, in Manchester.
- Articles on exotic weed control were placed in several of the states most read newspapers.
- Personnel from this department discussed the exotic weed control problem at many lake association meetings.
- Several exotic weed complaints were field investigated by DES personnel.

1982

- The Citizen Aquatic Weed Control Advisory Committee was formed.
- Educational material was distributed throughout the state to keep the public up to date on milfoil control. Boat license agents, state rest areas, boat marinas and lake associations received this material.
- Matching funds were awarded to Smith Cove Lake Association for mechanical harvesting of milfoil in Lake Winnepesaukee.
- Fifty lakes were surveyed for the presence of exotic weeds.
- A new infestation of milfoil was discovered in the outlet of Lake Waukewan by DES personnel. It was successfully eradicated with an aquatic herbicide.

1983

- The Smith Cove Lake Association in Gilford and the Wolfeboro Conservation Commission were awarded matching fund grants for the harvesting of milfoil in Lake Winnepesaukee.
- Educational material was distributed throughout the state.
- Fifty lakes were surveyed for exotic weed life by DES personnel.
- Several complaints or inquiries pertaining to exotic weeds were either field investigated or handled through correspondence.
- DES personnel presented several talks on weed control at lake association meetings during the summer.

- Correspondence to other states and countries experiencing exotic aquatic weed problems was initiated in order to obtain new or existing aquatic weed control techniques.

1984

- The Towns of Alton, Gilford, Meredith and Wolfeboro were awarded matching grants to mechanically harvest exotic milfoil in Lake Winnepesaukee.
- The West Alton Marina was awarded a matching grant to apply aquatic herbicide to their dock area to control milfoil.
- Educational material was distributed throughout the state.
- Fifty exotic weed surveys were performed throughout the state.
- A new infestation of milfoil was hand pulled at the boat launching facilities on Crescent Lake in Wolfeboro. SCUBA equipment was utilized during the operation.
- Several aquatic weed complaints were field investigated by DES personnel.
- Personnel from DES monitored a lake drawdown and dredging project that was undertaken to control exotic fanwort in Millville Lake in Salem.
- Several newspaper articles were published state wide pertaining to exotic aquatic weed control. The Boston Sunday Globe did an extensive feature story on exotic milfoil in Lake Winnepesaukee. "The Laker" in Wolfeboro printed an excellent article explaining the problem.
- DES personnel addressed the exotic plant control problems at lake association meetings during the summer.

1985

- Funding for exotic weed control was suspended due to a previously unknown legislative footnote. No weed control projects were funded this year.
- Fifty exotic weed surveys were performed on lakes throughout the state.
- Millville Lake was inspected for Cabomba growth following a dredging operation.
- Educational material was distributed throughout the state.
- DES SCUBA team removed a small patch of milfoil from Crescent Lake boat landing area in Wolfeboro.
- DES personnel addressed aquatic weed problems at lake association meetings.

1986

- Aquatic weed control program funds became available due to legislative action. However, no projects were funded that summer due to funds not being available in time.
- Fifty exotic weed surveys were undertaken during the summer months.
- Two papers entitled "A Review of Current and Experimental Methods for the

Control and Management of Aquatic Milfoil" and "Answers to Questions Concerning Aquatic Milfoil in New Hampshire Surface Waters" were written for distribution to the public.

- Educational material was distributed to lake associations, boat marinas, and the general public.
- Millville and Crescent Lakes were intensely surveyed for exotic weeds.
- Personnel from DES addressed aquatic weed problems at lake association meetings during the summer months.

1987

- Matching funds were awarded to the Town of Alton to undertake a milfoil dredging project in Lake Winnepesaukee.
- SCUBA divers removed small milfoil infestations at the Crescent Lake boat landing in Wolfeboro and in a section of the Winnepesaukee River in downtown Laconia.
- Two mechanical harvesting projects were planned for the summer. However, town officials could not obtain the necessary local funding to match the state's share.
- An attempt to dredge 10,000 square feet of milfoil and bottom substrate was canceled in Opechee Lake in Laconia. Heavy duty equipment became mired down in the deep muds near the milfoil infestation.
- Educational material was distributed throughout the state.
- Intensive exotic weed surveys were undertaken in seventeen lakes and ponds near Lake Winnepesaukee. These ponds were considered to be vulnerable to a milfoil infestation.
- Fifty exotic weed searches were performed on other state lakes.
- A grant of \$45,000 was awarded to the University of New Hampshire in Durham for Research on how to control exotic weed growth. Research was conducted in Back Bay in Wolfeboro on Lake Winnepesaukee.
- Private citizens participating in the New Hampshire State Assisted Lay Monitoring Program were instructed to report the sighting of any new weed growths in their respective lakes and ponds. The manual used by these lay monitors has a special section on exotic weed life.
- Millville Lake in Salem was checked for any regrowth of fanwort after a dredging operation. There has been no sign of fanwort in the lake to this date.
- A news release concerning exotic weeds and their potential spread to other lakes was distributed throughout the state media system.
- DES personnel participated in a workshop entitled "Nuisance Aquatic Weeds in New England". This workshop was sponsored by the New England Association of Environmental Biologists.
- A 4" x 6" educational handout card depicting how exotic weeds can be spread to

other lakes through boating activity was distributed to boat owners during registration of their respective boats.

1988

- The state initiated a "Weed Watcher Program" for lake residents. Volunteer weed watchers were given instruction kits which taught them how to look for exotic weeds in their respective lakes. Any weeds that were suspected to be milfoil or fanwort were submitted to the DES Biology Bureau for verification. The program was well received by the public.
- Fifty exotic weed surveys were performed during the summer as well as many field investigations of exotic weed complaints.
- Matching funds were awarded to the Smith Cove Lake Association for the harvesting of exotic milfoil in Lake Winnepesaukee.
- Benthic barriers were installed in Lake Opechee to control a small area infested with milfoil.
- DES personnel assisted on a private dredging project to control milfoil in Lake Opechee.
- Hand pulling of small infestations of milfoil were undertaken in Flints Pond, Crescent Lake, Lake Opechee and the Winnepesaukee River.
- A boat inspection program to detect "stowaway" exotic plant fragments was initiated during the summer of 1988. Participating towns were given \$2.00 per boat inspection. A questionnaire was also filled out by each person going through the inspection. Educational material was handed out to all boaters using these inspection launch sites. Towns participating were Meredith, Alton, Center Harbor (Winnepesaukee) and Sunapee (Lake Sunapee).
- Exotic milfoil was found in Turkey Pond, Concord and Flints Pond in Hollis during routine exotic weed surveys.
- Several boat docking facilities and launch sites were checked for the presence of exotic weeds during the summer.

1989

- A matching grant was awarded to the Locke Lake Association in Barnstead for the purpose of chemically treating 40 acres of exotic milfoil. The chemical called Diquat was used to control the milfoil.
- Lake shore residents along the northwestern section of Opechee Lake were awarded a matching grant to dredge milfoil and the bottom muds that sustain the exotic weeds. This was undertaken during a fall drawdown of the lake.
- St. Paul's School, located in Concord, was awarded a matching grant to mechanically harvest and hydrorake milfoil in Library Pond and Lower School Pond. The grant also provided for the application of lime to selected milfoil beds to determine if there was a reduction in biomass. The lime experiment was

intended to supplement the work previously undertaken on Lake Winnepesaukee in 1987.

- Fifty lake surveys were performed which included intensive searches for exotic weeds.
- Several complaints were investigated relative to sightings of exotic plants.
- A matching grant was awarded to lake residents in Paugus Bay in Laconia, for the purpose of controlling milfoil with a mechanical weed harvester. Boat movement through the area was impeded by the large amounts of exotic milfoil.
- Milfoil was confirmed to be growing in Contoocook Lake in Rindge. DES biologists spent a whole day mapping the extent of the problem in Contoocook Lake. Several meetings were scheduled between lake association residents and DES biologists to determine a course of action to curtail the milfoil infestation. After discussing the problem thoroughly with all concerned, it was decided that the use of an aquatic herbicide would be the most efficient milfoil management tool available. During the winter months, plans were drawn up, permits obtained and a weed control firm was hired to complete the plan.

1990

- Exotic milfoil was found in Northwood Lake during a routine inspection. Initially it was thought to be a small localized infestation. A SCUBA team revealed later that the milfoil encompassed a larger area not seen during the boat inspection. Since this was a pioneer infestation of milfoil it was decided that the best course of action to control the problem would be through the use of the herbicide called Diquat. The entire lake was surveyed for the presence of milfoil towards the end of the summer. The survey revealed that the initial infestation had spread to about 75 acres of the lake shore. Invitation for bids to control this problem were sent out and the necessary permits were obtained with a target date set for the spring of 1991 for the application of the chemical Diquat. DES funded 100% of the project.
- Contoocook Lake in Rindge received a matching grant from DES to treat 70 acres of milfoil. Aquatic Control Technology Inc. was selected to treat the lake with liquid Diquat. Milfoil had entered the lake about three to four years earlier but was not brought to the state's attention until 1989.
- A small patch of milfoil (50'x10') was found at the Mast Landing boat launching site in Crescent Lake, Wolfeboro. To prevent boats from transporting the milfoil into nearby Wentworth Lake, DES personnel used Aqua Screen, a bottom barrier, to smother the plants. The screen effectively killed the milfoil and is still in place to prevent further plant growth.
- Fifty lake water quality surveys were completed during the summer. During the survey aquatic weeds were noted.

1991

- During the month of June, approximately 75 acres of exotic milfoil in Northwood Lake was treated with the herbicide called Diquat. Since the milfoil was new to the lake system, the entire cost of the weed control operation was funded by the Department of Environmental Services (DES).
- The Fish Cove Lake Association and Mt. View Marina, both located on Lake Winnepesaukee, had severe infestations of exotic milfoil that precluded the recreational and commercial value of the waters. They each received matching grants to fund the application of the herbicide Diquat. Crescent Lake in Wolfeboro, also received a grant to treat 35 acres of milfoil with Diquat.
- A "weed watcher" on Lake Winnisquam notified DES that exotic milfoil was found in the northern section of the lake. DES personnel confirmed the milfoil sighting and sent two SCUBA divers to cover the small milfoil infestation with Aqua Screen. Any "straggler" plants were hand pulled by the SCUBA divers.
- A "weed watcher" from Lees Pond in Moultonboro noticed that some stands of milfoil in the pond were being eaten by some unknown animal. Closer inspection by DES personnel revealed that an aquatic moth was responsible for the apparent decline in the milfoil biomass. The aquatic moth was subsequently identified as Paraponyx allionealis. DES SCUBA divers observed and monitored the progress of the insect and mapped out the areas affected by the insect.
- A new sign warning lake residents that milfoil was growing in their respective lakes was designed and placed at the milfoil infested lakes, usually at the boat launching facility.
- Fifty lakes were surveyed for the presence of milfoil or other exotic weeds.
- DES personnel presented several talks on exotic weed control at lake association meetings during the summer months.
- Professional divers were hired to hand pull a new infestation of milfoil in Round Cove on Lake Winnepesaukee. This was a fifty-fifty match with the local residents. DES biologists monitored the project.

1992

- Round Cove located on Lake Winnepesaukee was given a matching grant to control a small encroachment of milfoil. A weed control firm was hired to apply liquid Diquat to the 5 acre cove. Mt. View Marina in Gilford was also given a grant to chemically control the obnoxious milfoil that interfered with boating activities.
- DES and the Town of Wolfeboro provided money for Brewster Academy to study the aquatic moth currently eating milfoil in Lees Pond in Moultonboro. The study examined the fundamental characteristics of the aquatic moth, such as food preferences, biomass consumption, and the life cycle. These studies were performed in Back Bay in Wolfeboro and Lees Pond. Initial tests performed in "live cages" showed that the insects will decrease milfoil if in sufficient numbers.

DES personnel assisted the researchers at Brewster Academy during the summer.

- A new exotic weed Myriophyllum spicatum was discovered growing in Mountain Pond in the Town of Brookfield. Otherwise known as Eurasian milfoil, this plant can spread very quickly to other ponds. A decision was made to drain the small shallow pond in an attempt to freeze and dry out the hardy plants. The beaver dam holding back the lake was breached during the fall. The plan is to let the pond stay down for at least two years. Several trips were made to the pond to insure that local beaver were not plugging the opening in the dam. As a last resort the pond may need a spot treatment of herbicides to insure that it does not spread to other nearby waterbodies.
- Exotic milfoil was found growing in Lake Winnisquam in the Towns of Tilton and Belmont. The combined total affected area was 7.81 acres. Since this was a new infestation of exotic weeds, the state was mandated to fund 100% of the weed control process. The decision was made to treat the two small areas with the herbicide 2,4-D. A request for bids to treat the two areas was sent out during the fall of 1992. A contractor was hired to obtain all the necessary permit from the Division of Pesticide Control and to apply the granular 2,4-D to the sites in Lake Winnisquam. Unfortunately, the project ran into difficulties over the issue of a nearby business using the lake as a drinking water source. The treatment area was too close to the drinking water source. The project was denied by the Division of Pesticide Control.
- The Wentworth Lake association applied for a matching grant from the state to chemically treat thirty five acres of milfoil in nearby Crescent Lake, Wolfeboro. This project also was denied due to a drinking water issue and the use of the aquatic herbicide 2,4-D.
- As in previous years, educational material was distributed to the public, exotic weed signs were placed at boat launching sites and talks relating to the exotic weed problem were given by DES personnel. Also, many weed specimens were submitted to DES for identification. Fifty weed surveys were performed on selected lakes in conjunction with a survey of the current water quality status of each waterbody.

1993

- The following were awarded matching grants from the state for the purpose of controlling exotic milfoil:
 - a. Mt. View Marina - Gilford; herbicide; 2,4-D
 - b. Lake Shore Park - Gilford; herbicide; 2,4-D

- c. West Alton Marina - Alton; herbicide; 2,4-D
- d. Contoocook Lake Association - Rindge/Jaffrey; herbicide; Diquat

Each site was severely infested with exotic milfoil to the point that recreational and commercial activities were impaired.

- "Weed Watchers" found three more lakes that harbored suspected stands of milfoil. Lower Suncook Lake, Lake Wentworth and Broad Bay were the latest victims of the milfoil encroachment. DES personnel covered the small stand of milfoil in Lake Wentworth with a benthic bottom barrier. The barrier physically constrains the weeds and ultimately smothers the plants within a month. Suncook Lake in Barnstead had scattered stands of milfoil near the outlet section of the lake. DES SCUBA divers placed bottom barriers on the milfoil. Each of the 5 stands of milfoil took about 300 square feet of bottom barrier. Any separately growing plants were hand pulled by the divers. During the fall drawdown of Lower Suncook Lake DES personnel patrolled the affected area searching for new milfoil growths missed during the summer. Any patches larger than 25 square feet were covered with barrier while "straggler" plants were individually hand pulled. The milfoil in Broad Bay (Bay Marina) seems to be confined to an area not larger than two acres. Local residents concerned about the problem are hand raking and pulling the milfoil plants. This area will be looked at more extensively next spring in order to decide what type of management approach will be undertaken to control the problem.
- In 1991 Northwood Lake was chemically treated to control exotic milfoil. The plants came back during the summer of 1992 and 1993. After a meeting with the lake association and DES personnel, it was decided to draw down the water in Northwood below the normal winter drawdown level. It is hoped that a cold winter will kill the newly exposed plant life.
- Officials from the Lake Wentworth Lake Association found milfoil growing in a small cove near Albee Beach in Wolfeboro. They notified DES officials of its presence and location on the lake. The plants did not have all the necessary taxonomic features needed to correctly identify the milfoil to species. However, since the milfoil was suspected to be an exotic species, it was decided that something should be done to ensure that it does not spread to the rest of the lake. DES personnel decided to cover the small area with bottom barrier. Approximately 1500 square feet of bottom barrier (Aqua Screen) were installed over the milfoil plants.
- Each year a Volunteer Lake Monitoring Workshop is held at DES headquarters in Concord. This year an aquatic weed workshop was given as well as an overview of the exotic weed program. These two programs were well attended by lake volunteers.
- Lake association members from New York state concerned about the current milfoil spread in their state asked a representative of DES to give a talk on the

New Hampshire exotic weed program. They are trying to get a similar program started in New York.

- A representative from DES gave a major exotic weed presentation at the annual "Bass Master" state chapter meeting held in Concord. Major emphasis was given to cleaning weeds from boats during the "Bass Master" competitions held at many lakes during the summer months.
- An exotic weed control talk was given at the annual "Lakes Congress" held at St. Paul's School in Concord. About one hundred representatives from the many lakes of New Hampshire attended the conference.
- A grant was given to Brewster Academy in Wolfeboro to do follow up studies on the insects that eat milfoil. DES personnel assisted on this project by supplying a dive team to perform some of the experiments. Local lake association people also got involved on this project.
- Approximately 300 weed watcher kits were given out to various lake associations throughout the state. Requests for the "kits" were received from other states.
- DES personnel periodically checked on the status of the Mountain Pond drawdown in Brookfield. Occasionally, beaver would attempt to plug up the breach in the dam. The mini drought experienced this summer took its toll on the exposed Eurasian milfoil plants. Once the plants dried up, land plants took their place.
- NH Fish & Game became the lead agency for the "Statewide Public Access Program." They have agreed to place DES exotic weed warning signs at all their new and existing public access points.
- Currently, a new exotic weed sign is being developed for distribution during the summer of 1994.
- Several routine exotic weed complaints were field investigated by DES personnel. Many suspect weeds were sent to the DES Limnology Center for identification.
- Fifty lake surveys to determine current water quality status were performed by DES biologists during the summer. A weed survey was undertaken during the survey. A search for exotic weed species was also performed on each lake or pond.
- Problems associated with milfoil and other exotic plants in NH generated several newspaper articles during the summer. This "free publicity" helped get the word out to the public informing them to be careful not to spread exotic weeds to other lakes and ponds through boating activities.
- A weed watcher from the northern section of Lake Winnisquam notified DES biologists that a small patch of milfoil had appeared in one of the coves. SCUBA divers successfully hand-pulled the plants before they spread to other sections of the lake.

1994

- Pioneer infestations of exotic milfoil were found in Lake Waukewan, Meredith; Cheshire Pond, Jaffrey; Broad Bay, Freedom; and Silver Lake in Tilton.

Lake Waukewan, Meredith -DES biologists found approximately 1.5 acres of the exotic milfoil in the outlet/canal section of Lake Waukewan during a routine water quality inspection. This same general area had milfoil in 1981 and was successfully treated and controlled with a chemical herbicide in 1982.

Cheshire Pond, Jaffrey -A resident on Cheshire Pond in Jaffrey reported sighting milfoil in a beach area. A DES biologist confirmed the milfoil to be exotic. The milfoil probably floated downstream from nearby Contoocook Lake ultimately taking hold in the pond. A temporary drawdown of the pond was initiated during the month of December in an attempt to freeze the milfoil plants.

Silver Lake, Tilton - Exotic milfoil was found in Silver Lake in Tilton by the University of New Hampshire lay monitoring officials. DES responded to the problem quickly by hand pulling the plants and digging up the remaining plants during a fall drawdown of the lake. This site will be inspected in the spring of 1995 for signs of regrowth.

Broad Bay, Freedom -DES biologists had trouble identifying the milfoil at this site in 1993 because the plant did not exhibit flowers which are critical to a positive identification. However, in 1994 flowers did appear and the plant was identified as exotic milfoil. This site will be chemically treated in 1995.

- Three matching grants were awarded to lake associations in 1994 for the purpose of exotic weed control. They were as follows:

<u>Association</u>	<u>Lake</u>	<u>Town</u>	Type <u>Exotic</u>	Control <u>Method</u>
a. Locke Lake Assoc.	Locke Lake	Barnstead	milfoil	chemical
b. Meredith Yacht Club	Winnepesaukee	Meredith	milfoil	chemical
c. St. Pauls School	Turkey Ponds	Concord	milfoil	mechanical harvesting

- DES biologists performed several underwater exotic weed surveys with the aid of SCUBA equipment. These surveys were done to get an accurate assessment of the milfoil infestations.
- A new sign designed to educate boaters was made and placed at many boat launches throughout the state.
- Northwood Lake in Northwood was lowered in November so that the state could replace the old dam. The lake was drawn down all winter and did slow down the milfoil growth along the shoreline.
- Several informational talks were presented at lake association meetings by DES

biologists. A radio talk show on exotic weeds was aired in Lebanon, while a local TV station did a major news segment on the exotic weed control program.

- DES personnel went to a meeting in Vermont to discuss new methods of controlling exotic weeds.
- Several hundred “weed watcher kits” were requested by the public. This volunteer program has been very successful over the past few years.
- Several suspected exotic weed sightings by weed watchers or other concerned lake residents were investigated by DES biologists. Many samples were sent to the Limnology Lab for identification.
- Fifty more exotic weed surveys were performed during the summer. These surveys supplement the weed watcher efforts performed by volunteers.
- Five milfoil contracts were put out to bid in 1994. These weed control projects will occur during the spring of 1995.
- Mountain Pond in Brookfield, which originally had Eurasian milfoil is still empty. There is no sign of any milfoil in the small stream that flows through the empty pond.

1995

- The outlet section of Lake Waukegan in Meredith was treated with the herbicide called Aqua Kleen. Aquatic Control Technology, Inc. of Northborough was hired by DES to undertake the project. If the milfoil had not been controlled there was a good chance it may have spread through the rest of the lake. It would have been impossible to treat the main lake since the Town of Meredith uses the lake for drinking water. An inspection of the treatment area with SCUBA gear did not reveal any milfoil plants. The treatment was a success.
- Lower Suncook Lake in Barnstead had six acres of milfoil treated with the herbicide called Reward. Lycott Environmental Research, Inc. of Southbridge Massachusetts was hired by DES to perform the treatment.
- Crescent Lake in Wolfeboro was also treated with the herbicide called Reward. An inspection of the treated area in the fall revealed no milfoil. To date treatment efforts have kept milfoil from invading the main section of nearby Lake Wentworth.
- Mountain Pond in Brookfield is still drained. Still no signs of Eurasian milfoil.
- Eurasian milfoil was found growing in the Connecticut River in Charlestown. A large boat launching facility on the Vermont side of the river is used by fishermen from both states. Vermont officials were notified of the milfoil. They posted warning signs near the launch site. Leaflets informing the public about the milfoil were handed out to the boating public at a toll booth as they crossed from New Hampshire into Vermont.
- A “weed watchers wheel” was developed to distribute to the public to aid them in their search for exotic weeds. The wheel accompanied the standard “weed watcher kit” used by lake monitors.
- The proposal to treat Broad Bay in Freedom with herbicides was terminated due

- to time constraints and permitting problems.
- Contoocook Lake Association received a matching grant from the state to chemically treat small areas of milfoil. The herbicide called Diquat was used in this project.
- Several milfoil talks were given to lake associations during the summer.
- Benthic barriers were installed in a small cove on Wentworth Lake to control a small stand of milfoil.
- Milfoil was hand pulled in Lower Suncook Lake by SCUBA divers from DES.
- Eight proposed herbicide applications for the purpose of milfoil control were submitted to the Governor and Council for approval. The projects were as follows:
 - a. Broad Bay, Freedom
 - b. Lakeshore Park, Gilford
 - c. Mt. View Marina, Gilford
 - d. West Alton Marina, Alton
 - e. Winnisquam Lake, Belmont
 - f. Silver Lake, Belmont
 - g. Cobbetts Pond, Windham
 - h. Fish Cove, Meredith
- Exotic milfoil was found at Claire's Boat Landing on Lake Massabesic in Auburn. This lake is Manchester's water supply. Benthic barriers were placed on a large portion of the milfoil. The use of herbicides was not allowed due to the drinking water status of the lake. Manchester Water Works personnel moved the benthic barriers to other milfoil sites as needed.

1996

- Eight herbicide applications to control milfoil occurred during the month of June. They are as follows:
 - a. Broad Bay, Freedom
 - b. Lakeshore Park, Gilford
 - c. Mt. View Marina, Gilford
 - d. West Alton Marina, Alton
 - e. Winnisquam Lake, Belmont
 - f. Silver Lake, Belmont
 - g. Cobbetts Pond, Windham
 - h. Fish Cove, Meredith
- Two new infestations of milfoil were confirmed by the DES staff. Captain Pond in Salem and Lake Massasecum in Bradford now possess the nuisance weed.
- SCUBA divers checked Lake Waukegan for any signs of milfoil regrowth one year after it was treated. No milfoil plants were observed during the dive.
- Milfoil was discovered growing in the northern end of Lake Winnisquam.
- A milfoil education display was presented at the Fish and Game Department "Discover Wild New Hampshire Day."
- A similar display was also presented at "Celebrate Your Lakes Day" held this summer in Meredith.

- Milfoil informational talks were given throughout the summer at many lake association meetings.
- A talk was given to the Fish and Game Department volunteer fishing instructors on how to look for exotic weeds throughout the state.
- Ken Warren attended a National Weed Control Conference held in Burlington Vermont in July. Several papers on new promising control techniques were presented.
- Benthic barriers were placed on a small infestation in Lake Winnisquam.
- Mountain Pond in Brookfield was checked for any regrowth of Eurasian milfoil. No plants were found during the inspection.

1997

- Six herbicide applications were performed in the spring to control nuisance growths of exotic aquatic plants:
 - a. Northwood Lake, Northwood
 - b. Lake Winnepesaukee, Mountain View Marina, Gilford
 - c. Lake Winnepesaukee, Meredith Bay, Meredith
 - d. Lake Massasecum, Bradford
 - e. Lake Winnepesaukee, Krainwood Shores, Moultonboro
 - f. Locke Lake, Barnstead
- Benthic barriers were placed in Heath Bog of Lake Wentworth, Wolfeboro, Lake Massabesic in Auburn, Lake Massasecum Bradford, as well as in small localized areas in other lakes.
- A new infestation of milfoil was documented at Claire's Boat Landing on Lake Massabesic in Auburn, and Powder Mill Pond in Hancock.
- SCUBA divers inspected several small infestations of milfoil and hand-pulled plants where they were encountered in low densities.
- Several displays were presented at summer events and festivals including "Celebrate Your Lakes Day", and "Discover Wild New Hampshire Day."
- Informative presentations were given at a number of lake association meetings throughout the summer.
- HB 181 was passed prohibiting a number of activities associated with exotic aquatic plants.

1998

- RSA 487:16-a went into effect on January 1, 1998. This new law prohibits the sale, distribution, importation, purchase, propagation, transportation, or introduction of 14 listed exotic aquatic plants in New Hampshire. The new statute also allows for the designation of restricted use areas on waterbodies.
- On September 5, 1998 new rules were enacted pursuant to RSA 487:16-a.

- Benthic Barriers were placed in Lake Winnepesaukee in Meredith, Lake Wentworth in Wolfeboro, Contoocook Lake in Jaffrey, Hopkinton Lake in Hopkinton, Lake Massabesic in Auburn, and Lake Massasecum in Bradford, as well as in small places in an additional 2-3 lakes.
- Maintenance hand-pulling activities took place at a number of lakes with new and existing milfoil infestations.
- The following herbicide applications were performed during the Spring:
 - a. Forest Lake, Winchester
 - b. Captains Pond, Salem
 - c. Sunrise Lake, Middleton
 - d. Contoocook Lake, Jaffrey
 - e. Lake Winnepesaukee, Gilford
 - f. Lake Winnepesaukee, Moultonboro
 - g. Lake Winnepesaukee, Tommy Cove, Meredith
- A number of summer lake festivals were attended by the Exotic Species Coordinator, including "Celebrate Your Lakes Day," "Naturally Newfound," "Discover Wild New Hampshire Days," and Keene State College "Solarfest".
- Several presentations were given to towns and lake associations throughout the state on exotic aquatic plants.
- Exotic species signs which are posted at boat launches throughout the state were revised to include the changes in legislation associated with exotic plants.
- A number of milfoil control activities were conducted this summer at Lake Massasecum in Bradford. Benthic barriers were installed, a restricted use area was established in the north cove, and a net was placed across the surface of the water (vertically in water column) to trap floating fragments of milfoil.
- 500 specimens of variable milfoil (*Myriophyllum heterophyllum*) were sent to the Army Corps of Engineers, Waterways Experimental Station in Vicksburg, MS for research on control methods. Garlon 3-A, a new herbicide that is thought to be more effective and environmentally sound than 2,4-D, was used to treat the plants. More extensive research will be conducted this spring.

1999

- Eurasian milfoil found in Lake Mascoma in Enfield. Numerous diving operations were conducted to hand remove the milfoil.
- 'Suspicious patches of milfoil found in Horseshoe Pond in Merrimack and in Belleau Lake, Wakefield. Plants did not flower so positive identifications were not made. Plan to investigate again in 2000.
- Nine herbicide applications were conducted this year. Most were in various portions of Lake Winnepesaukee. Other treatments were conducted at the following waterbodies:
 - Contoocook Lake, Rindge
 - Lake Monomonac, Rindge
 - Captains Pond, Salem
 - Crescent Lake, Wolfeboro

- Lake Wentworth, Wolfeboro
- Numerous presentations were given to lake associations about exotic plants

2000

- New Variable milfoil infestations documented in Little Squam Lake and Squam River, Holderness/Ashland, Danforth Pond, Ossipee, and Rocky Pond, Gilmanton.
- Re-investigations of the two suspect infestations of milfoil from summer of 1999 confirmed that the species of milfoil in Belleau Lake, Wakefield, and Horseshoe Pond, Merrimack were indeed the variable milfoil.
- Herbicide applications conducted at the following locations in 2000:
 - Lake Winnepesaukee, Meredith, Gilford, Center Harbor, Moultonboro, and Alton
 - Northwood Lake, Northwood
 - Locke Lake, Barnstead
 - Lake Monomonac, Rindge
 - Contoocook Lake, Rindge
- Innovative milfoil management activities taking place on Lake Massasecum, Bradford. Lake Association, through funding from NHDES, have constructed harvester to repeatedly harvest milfoil in northern cove of lake.
- RUA installed in Little Squam Lake to contain milfoil.
- Hand-pulling conducted on milfoil in channel connecting Big and Little Squam Lakes.
- Research on milfoil impacts to property values initiated at UNH.
- RSA 487:16-b went into effect making it unlawful to knowingly, recklessly, or purposely offer for sale, distribute, sell, import, purchase, propagate, or introduce exotic aquatic weeds into New Hampshire waterbodies. The new law makes it a violation to conduct any of the above listed activities.

2001

- New Variable milfoil infestations documented in Lake Sunapee, Sunapee at Georges Mill, and Dublin Lake in Dublin.
- A new invasive plant was first documented in New Hampshire. *Egeria densa*, also known as Brazilian elodea, was found in Nutts Pond in Manchester.
- Herbicide applications conducted in 20 waterbodies, the most waterbodies ever treated in one summer in New Hampshire.
- Innovative milfoil management activities taking place on Lake Massasecum, Bradford. Lake Association, through funding from NHDES, have continued harvesting activities and installing bottom barriers.
- RUA installed in Little Squam Lake and Lake Sunapee to contain milfoil.
- Hand-pulling conducted on milfoil in channel connecting Big and Little Squam Lakes, Dublin Lake, and Lake Sunapee.
- Research on milfoil impacts to property values by UNH suggests a 16+% decline in lakefront property values.

Appendix Three

NHDES Exotic Aquatic Species Program

Education and Outreach Materials

ENVIRONMENTAL Fact Sheet



6 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.state.nh.us

WD-BB-4
1999

Revised

Weed Watchers An Association to Halt the Spread of Exotic Aquatic Plants

Milfoil (*Myriophyllum heterophyllum*, *Myriophyllum spicatum*) and fanwort (*Cabomba caroliniana*) are exotic aquatic plants that have become economic and recreational nuisances in some of New Hampshire's lakes and ponds. Dense stands of these plants inhabit shoreline areas frequented by water based recreationalists. Exotic plants can create the following problems:

- Displacement of beneficial wildlife.
- Reduction of aesthetic quality of lakes.
- Devaluation of waterfront property.
- Littering of beaches with plant fragments.
- Makes swimming difficult and dangerous.
- Snags fish lines and stunts fish life.
- Becomes tangled in outboard motor propellers.
- Chokes boat traffic lanes.
- Requires substantial funds for managing.

The spread of these plants to other uninfected waterbodies by transient boat traffic has increased over the last few years. If accidentally introduced into a lake, they grow at explosive rates. Many times new infestations are not discovered by state biologists until the weeds become a nuisance requiring expensive control methods. Once fully established, they are virtually impossible to eradicate. Therefore, education, vigilance, and early detection are key components in keeping these non-native nuisance weeds in check.

A Weed Watchers, a volunteer association dedicated to monitoring the lakes and ponds for the presence of exotic weeds, was formed by the NH Department of Environmental Services in 1988. Volunteers are given a special A Weed Watchers Kit which contains the following:

- Photographs of exotic plants.
- Detailed drawings of the plants.
- An information bulletin on exotics.
- A list of lakes known to have exotic plants, including a map.
- Recommendations on how to conduct a plant survey.

- A complete set of fact sheets and pamphlets on exotics in NH.

The Weed Watchers Kit can be sent to you at no expense. Any individual wishing to participate in the A Weed Watchers program should contact the Exotic Species Coordinator at:

Department of Environmental Services
Biology Bureau
6 Hazen Drive
PO Box 95
Concord, New Hampshire 03302-0095
(603)271-3503

What does a Weed Watcher provide?

All that weed watching involves is a small amount of time during the summer months. Volunteers survey their waterbody once a month from June through August. To survey, volunteers slowly boat around the perimeter of that waterbody and any islands it may contain. Using the materials provided in the Weed Watchers Kit, volunteers will then look for any species that are of suspicion and send them to DES. After a trip or two around the waterbody, volunteers will have a good knowledge of its plant community and will immediately notice even the most subtle changes.

What happens if a Weed Watcher finds an exotic plant in a waterbody?

In most cases, volunteers will be instructed to send a plant specimen through the mail or deliver the specimen in person. Please try to collect a portion of the suspect plant when it is in flower. This may be the only way to precisely identify the plant. If the plant is an exotic, a biologist will visit the site to determine the extent of the problem and to formulate a plan of action to control the nuisance infestation.



ENVIRONMENTAL Fact Sheet

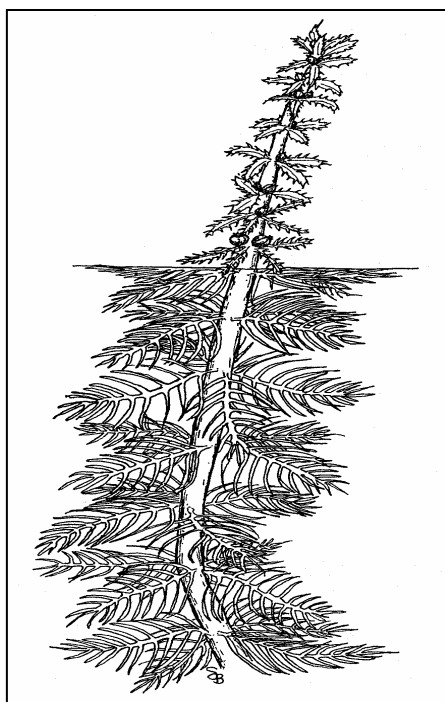


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WD-BB-23

Revised 2002

Variable milfoil **Myriophyllum heterophyllum (Michx)**



Species Description/General Information

Milfoil is a submerged aquatic plant with fine densely packed, feather-like leaves whorled around a main stem. It can grow up to 15 feet and may exhibit a three- to six-inch green spike-like flower above the waterline in July. A cross-section of the stem will reveal “pie-shaped” air chambers.

This exotic species of milfoil has been in the state since the late 1960s, and can currently be found in over 50 waterbodies in New Hampshire. There are six native milfoil species present in the state that do not cause problems. Eurasian milfoil is another non-native milfoil found in New Hampshire, but it is less of a threat than variable milfoil due to our water chemistry.

Why is Milfoil Considered a Nuisance Species?

This species is not native to our state and is very difficult to control once it becomes fully established. Milfoil reproduces through fragmentation whereby plant fragments break off from the parent plant through wind or boat action, grow roots, and settle in a new location. Milfoil spreads rapidly and displaces beneficial native plant life. It makes swimming difficult and can devalue waterfront property. Where this species grows in its native environment, insects and fish may feed on this plant at such a rate as to control its growth. In New Hampshire, milfoil has no natural predators to keep its population in check. Under optimum temperature, light and nutrient conditions, milfoil may grow up to an inch per day.

How Did Exotic Milfoil Become Established in This State?

It was most likely a “stowaway” fragment attached to a boat or trailer that came to this region. Milfoil can live out of water for many hours if it remains moist, like when it’s wound around a wet carpeted bunk on a boat trailer. Milfoil is usually first found near boat launch sites.

Another theory is that milfoil was introduced to a New Hampshire waterbody through the dumping of a home aquarium. This plant is sometimes used as an ornamental plant in fish aquariums.

Once Established, How Does Milfoil Infest Other Areas of a Waterbody?

Boat propellers will chop milfoil plants into small fragments. These fragments float on the surface and are at the mercy of the wind and lake currents. In a short time, roots form on these fragments. If washed ashore, these plants eventually take hold creating a new colony of milfoil. The cycle goes on until every suitable area is filled in with these weeds. An alternative form of the plants develops during low water. This vegetation type is more succulent than the submersed form.

What Methods Are Currently Being Used to Control Milfoil?

Three methods are currently used to control variable milfoil. Hand-pulling of new infestations is one way to prevent a full-lake infestation, but these patches must be detected early. When the plants become too large to hand-pull, a benthic barrier may be placed on the lake bed by State divers to compress the plants to the bottom and block sunlight. This works only in very small patches. The other method for controlling plants when they become too large to pull or cover is the use of an aquatic herbicide. These herbicides can provide one to three years of control in a waterbody.

There is no way to eradicate the plant once it has become well established in a waterbody. DES is currently working with Dartmouth College to determine the genetics of the milfoil plants and to see if there is a possibility for future genetic control of the plant.

Have Chemicals Been Used to Effectively Control Exotic Milfoil?

One chemical treatment in the spring, during peak plant growth, is sufficient for milfoil control for the remainder of the treatment season, and perhaps into the next. Chemicals are usually the method of choice for small new infestations that are too large for hand-pulling or screening. However, attempts to eradicate extensive areas of weeds using chemicals are rarely effective. In most cases, the treated area becomes re-infested with fragments from other sections of the lake.

It is illegal to apply chemical herbicides to any New Hampshire waters unless you contract with a licensed applicator. The use of chemicals by an untrained person could jeopardize the health and welfare of the lake and its ecology. Inappropriate or inaccurate use of chemicals is life-threatening to people. It should be noted, however, that the state has been conducting herbicide

applications for several years, and no negative impacts to non-target plants, animals, or humans have been observed.

For more information on milfoil or other Exotic Species, please contact the Exotic Species Coordinator at 603-271-2248 or asmagula@des.state.nh.us. Also, visit the Exotic Species website at www.des.state.nh.us/wmb/exoticspecies/.

ENVIRONMENTAL Fact Sheet



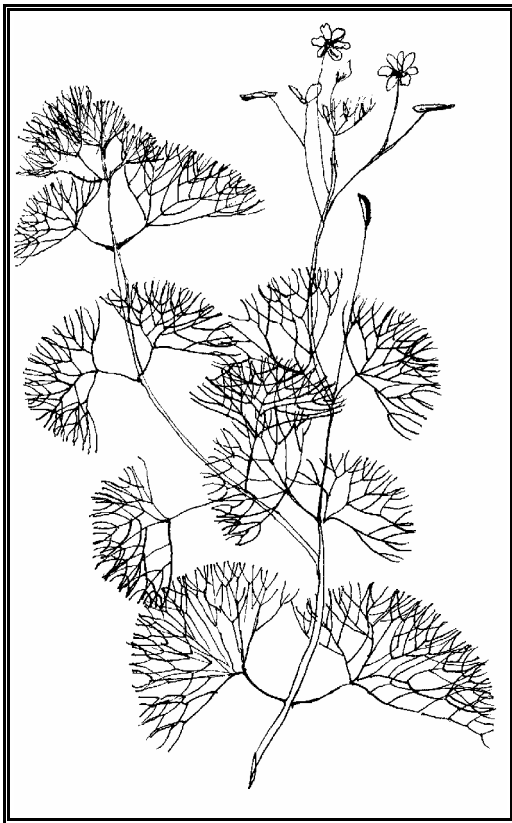
6 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.state.nh.us

WD-BB-25

Revised 1999

WANTED! **Information on the location of this exotic plant**

Fanwort



Species Description

(Cabomba caroliniana)

Fanwort is a submerged bright green aquatic plant with narrow leaves arranged in a fan shape manner oppositely located on a long narrow stem. Floating, lily-like leaves are found on the water=s surface during flower production. Flowers are small, white, and emergent. This stem plant stands approximately 20 inches tall, with its slender stem coated in a gelatinous slime. Leaf segments are approximately 1mm wide. Fanwort flowers from July through September.

General Information

Fanwort is a native plant of the southern United States, and Latin and South America. It is currently found in Arlington Mill Reservoir in North Salem, Island Pond in Derry, Phillips Pond in Sandown, Mine Falls Pond in Nashua, and the Nashua River in Nashua. This exotic plant was discovered in New Hampshire in the late 1960's and entered the state via the back of a transient boat trailer or was dumped from a tropical fish aquarium. Characteristic of many

**Please contact DES if you
have seen this plant.**

exotic plants introduced to a new environment, Fanwort quickly invades shoreline areas of waterbodies, ultimately impairing recreational activities.

ENVIRONMENTAL Fact Sheet



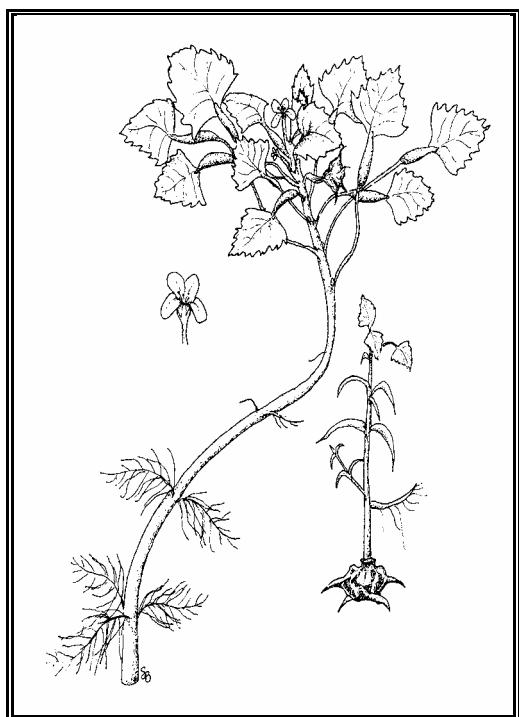
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WD-BB-43

Revised 1999

Water Chestnut Discovered in New Hampshire Waters

Water Chestnut



(Trapa natans)

In July 1998, the NH Department of Environmental Services (DES) confirmed reports that the exotic aquatic plant water chestnut has infested the Nashua River in Nashua. Water chestnut can completely cover the surface of a waterbody and cause ecological hardship to native plants and animals. Fishing and boating can become extremely difficult as well.

This plant is not the same species as the edible water chestnut used in Asian cooking. Water chestnut is a member of the Trapaceae family and derives its name from the single-seeded horned fruits, the Achestnuts. Each of the four horns on the nut is sharp and has a spine with several barbs. Each plant has two types of leaves: submerged leaves that are feather-like and oppositely paired along the stem, and waxy floating leaves that are triangular and form a rosette on the water's surface. The petiole (leaf stalk) of the floating leaves has a bladder-like swelling filled with air and spongy tissue which provides buoyancy. Cord-like plant stems can attain lengths of up to 16 feet.

The water chestnut is an annual plant which exhibits great reproductive capacity. The seeds germinate in early spring. An individual seed can give rise to 10-15 rosettes, each of which can produce 15-20 seeds. Thus, one seed can produce 300 new seeds

in a single year.

Water chestnuts begin to flower in mid to late July, with their nuts ripening approximately one month later. Flowering and seed production continue into the fall when frost kills the floating rosettes. The mature nuts sink to the bottom when dropped and may be able to produce new plants for up to 12 years. The plant spreads either by the rosettes detaching from their stems and floating to another area, or more often by the nuts being swept by currents or waves to other parts of the lake or river. The plant overwinters entirely by seed.

ENVIRONMENTAL Fact Sheet



6 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.state.nh.us

WD-BB-17

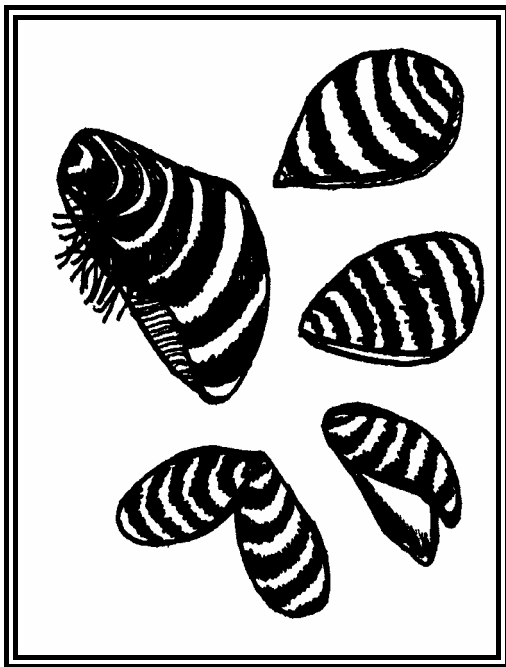
Revised 1999

Zebra Mussels

Zebra Mussel (*Dreissena polymorpha*)

What are Zebra Mussels and Where Do They Come From?

Zebra mussels are small shellfish marked by alternating light and dark bands. They are typically 2 inches or less in size and have a life span of 4-8 years. Zebra mussels have an extremely high reproductive rate of 30,000-1,000,000 veligers per year and are able to reproduce at one year of age.



Zebra mussels are native to the drainage basins of the Black, Caspian, and Aral Seas of Eastern Europe. It is believed that ships originating from European ports carried the mussel in freshwater ballast which was discharged into Great Lake ports. The first North American zebra mussel discovery was in Lake St. Clair, Michigan in June of 1988. By September, 1991, the mussel was found in all five of the Great Lakes, the St. Lawrence River, the Finger Lakes region of New York, and throughout the Mississippi River basin. The mussel is expected to infest most areas of North America within the next few years. During the summer of 1993 the zebra mussel was discovered in Lake Champlain, Vermont. In 1998, the mussel was found in East Twin Lake, Connecticut. With infestations to the south and west, it is anticipated that

their arrival in New Hampshire is just a matter of time.

Adult and juvenile mussels are transported by waterfowl and by attachment to boat hulls, crayfish and turtles. Large stage mussels (veligers) can be transported in anglers' bait bucket water and boat engine cooling water. Similar to other introduced non-native species such as milfoil, these exotic mussels can reproduce rapidly because natural predators are not present to keep the population in check.

Why are Zebra Mussels a Concern in North America?

Zebra mussels are not native to the United States. They disrupt the ecology and cause problems to humans wherever they have appeared. Zebra mussels are the only freshwater mussel that can secrete durable elastic strands, called byssal fibers, by which they can securely attach to nearly any surface, forming barnacle-like crusts. Through this mechanism zebra mussels can attach to stone, wood, concrete, iron, steel, aluminum, plastic, fiberglass, and PVC. They have also recently been found growing on softer substrates like plants and even mud.

What Problems Do Zebra Mussels Cause?

The zebra mussel's ability to rapidly propagate and physically attach to objects creates several problems:

- C Zebra mussels filter small particles such as phytoplankton (microscopic plants), small zooplankton (microscopic animals), and detritus (pieces of organic debris) from water. Mussels are capable of filtering up to 1 liter of water within a 24 hour period. Large populations of zebra mussels can severely alter the lake or riverine food web by competing with existing species such as salmon and walleye.
- C Raw water intakes such as those at drinking water, electric generation, and industrial facilities can become infested with zebra mussels. A water supply system serving 50,000 people in a Michigan city had to shut down due to pump failure by zebra mussels in its intake system.
- C Beaches in infested areas may be impacted by the washing up of sharp shells in shallow areas, which can cut bathers and litter beaches. Decomposition of mussels can also create obnoxious odors.

Impacts on boating and navigation include:

- C Organisms attached to hulls increase drag, reduce speed, thus increasing fuel consumption.
- C Growth of larval mussels drawn into a boat's engine cooling water intake may occlude the cooling system, leading to overheating and possible damage to the engine.
- C If shells are drawn into the engine, abrasion of cooling system parts, especially impellers, could result.
- C Marker buoys can sink under the weight of mussel encrustation.
- C Docks can be destabilized or sunk by mussel colonization.

What Kind of Habitat Do Zebra Mussels Prefer?

Zebra mussels can tolerate fairly wide ranges of environmental conditions. They prefer water temperatures between 68 and 77 degrees F and water currents 0.15 to 0.5 meters per second for proper growth. The mussels prefer spawning in water temperatures in the mid 50's °F. While normally a freshwater species, the zebra mussel can adapt to and inhabit brackish waters ranging from 0.2 to 2.5 parts per thousand total salinity in estuarine locations. Zebra mussels prefer lakes that are not overly enriched but which have a higher calcium content. Given the mussel's

preference for higher calcium levels, some NH waterbodies are at a risk for infestation , especially waterbodies with calcium levels greater than 12 ppm, like the Connecticut and Merrimack Rivers.

How Can Zebra Mussels Be Controlled?

An effective way to permanently eliminate infestations has not been found, therefore, emphasis must be placed on controlling impacts on ecosystems and water users. For drinking water, electrical generation and industrial facilities, screen mesh can exclude adult and juvenile mussels from water intake systems. This method is only effective in excluding those mussels which originate upstream of the screens or filters. Veligers can pass through the screens and infest downstream areas. Other controls for water intakes include increasing intake and distribution flows to rates exceeding those at which zebra mussels can attach and physically scraping the mussels where access for personnel and equipment is available. Oxygen deprivation, thermal controls (exposing mussels to water temperatures greater than 140 °F), and chemical controls can be used to kill the mussels. However, these methods will likely affect other aquatic organisms.

What Can Citizens Do To Help?

Tell your lake, river or watershed association, your local marina, your municipal officials, or anyone with an interest in water management about the zebra mussel. If you are in the power generation industry, plan now for the mussel=s invasion to your facility. Call the UNH Cooperative Extension Services or NH Sea Grant, both in Durham, to learn about their zebra mussel public education program. You can also contact the DES, as the state agency with the primary responsibility of protecting and managing the state=s lakes and rivers. DES intends to take an active role in zebra mussel prevention and control.

When boating in infested waters, be sure to Ade-mussel≡ your boat before you leave the area. ADe-musseling≡ includes preforming the following activities AWAY FROM ANY SURFACE WATER:

- C Draining the bilge, live wells and engine cooling system.
- C Dumping any bait buckets.
- C Inspecting the boat by checking the hull, trim plates, anchors, and the trailer.
- C Washing down the boat with hot water (140 °F), if mussels are found, and allowing the boat and trailer to sit for 2-5 days dry.

Participate in a zebra mussel monitoring program. Again, UNH and Sea Grant can be contacted at (603)749-1565. They will provide you with information you need to identify the zebra mussel so you can actively monitor your river, lake, and/or power generation facility. The best defense is to prevent the zebra mussel from entering the waters of New Hampshire. However, when they arrive, we all need to implement the proper controls to prevent these undesirable invaders from spreading.

BB-45

1999

Purple Loosestrife: An Exotic Menace



Description....erect (1-2m), perennial herb with a square, woody stem and opposite or whorled leaves. Purple loosestrife flowers from July through August in New Hampshire, and is named for its bright purple flower that spikes from the top of the plant. One plant may grow as an individual stalk or as several stalks clumped together.

How was purple loosestrife introduced?

Purple loosestrife is native to Eurasia. It was originally introduced to eastern North America in the early to mid 1800's. This invasive plant was probably accidentally introduced via ship ballast or brought over for use as an ornamental plant.

Where does purple loosestrife invade?

Optimum habitats include freshwater marshes, open stream margins, and alluvial floodplains. Purple loosestrife also occurs in wet meadows, river banks, and edges of ponds and reservoirs. It favors fluctuating water levels and other conditions often associated with disturbed sites, such as construction sites for docks or marinas. Purple loosestrife is often associated with cattail, reed canary grass, and other moist soil plants.

What makes purple loosestrife a good invader?

Purple loosestrife tolerates a wide range of environmental conditions (temperature, shade conditions, pH, nutrient levels) and can establish on a variety of substrates (gravel, sand, clay, and organic soil). It has an incredible ability to out-compete native vegetation and to form dense stands. Furthermore, Purple loosestrife has no natural enemies in North America.

How does purple loosestrife spread?

Purple loosestrife's ability to spread contributes to its success as an invader. One loosestrife plant can produce millions of seeds annually. Seeds are long-lived and easily dispersed. Also, purple loosestrife plants are capable of resprouting from broken stems or roots. The plants have strong root stocks that serve as storage for spring regrowth and regenerations following natural or human disturbance. Finally, the commercial sale of purple loosestrife increased the spread of the plant by introducing it to various watersheds.

Why is purple loosestrife a problem?

Purple loosestrife is a problem because it negatively affects wildlife and agriculture. Purple loosestrife displaces and replaces native flora and fauna, eliminating food and shelter for wildlife. By reducing habitat size, purple loosestrife has a negative impact on fish spawning and waterfowl habitats. The plant also diminishes wetland recreational capability. Purple loosestrife affects agriculture by blocking flow in drainage and irrigation ditches and decreasing crop yield and quality.

Are other states having problems with this nuisance plant?

Purple loosestrife is a problem throughout North America. The northeastern United States and southeastern Canada are the areas experiencing the greatest impact of purple loosestrife. The distribution of this plant ranges from being common to abundant, and many areas have been found to support dense stands of this invasive plant. Purple loosestrife occurs in lower densities across virtually the entire United States and southern portion of Canada.

What are some solutions to the purple loosestrife problem?

Three possible control methods exist: physical, biological, and chemical. These methods will not completely eliminate purple loosestrife, but they will control the populations within ecologically acceptable limits.

Physical control of loosestrife is possible for stands of smaller size (less than 100 plants). It involves physically removing the plants from the soil at the root. Removal should ensure that all root and plant pieces are dug out of the soil. The best time to remove the loosestrife from the soil is prior to seeding time just before the plant blooms (removal after this time will not eliminate the seeds which have already been produced by the plant. Once the plants are removed they should be burned or tightly bagged to prevent the spread of seeds or resprouting. Physical removal of small stands of purple loosestrife can be accomplished in the following manner:

- cut off flower spikes prior to early July and bag or burn them
- dig out stalks or cut them off as close to the ground surface as possible
- tightly bag or burn the stalks
- be careful to separate stalks from other plant material

Many local conservation commissions, garden clubs, and other specialty groups throughout New Hampshire are initiating their own loosestrife monitoring programs involving mapping, hand-pulling, and disposal of this nuisance plant.

Biological control is a method of control involving the release of predators to attack the pest species. Three different species have been used in North America to attempt to control Purple

loosestrife: two species of beetles, and one weevil. These three species are common in Europe where they combine to act on the leaves and roots of Purple loosestrife, thereby controlling its populations. Several years of field trials will be necessary to determine whether biological control methods have real potential to effectively control Purple loosestrife.

The New Hampshire Department of Agriculture (NHDA) and the NH Department of Transportation (NHDOT) are working on a joint project to introduce beetles into areas infested with purple loosestrife. The beetles feed on the plants, curbing their growth in a five year period, depending on the size of the infestation.

Chemical control has not received FDA approval and the use of chemicals to combat Purple loosestrife is many years away.

BB-40

1999

Law Prohibits Exotic Aquatic Weeds

As of January 1, 1998, the sale, distribution, importation, purchase, propagation, transportation, or introduction into the state of exotic aquatic weeds is prohibited (RSA 487:16-a). This new law was designed to act as a tool for lake managers to help prevent the spread of nuisance aquatic weeds. It is hoped that by preventing their transport over land, their spread between lakes will be stopped.

The following is a list of prohibited exotic aquatic species in New Hampshire:

<i>Scientific Name</i>	Common Name
<i>Myriophyllum heterophyllum</i>	variable milfoil
<i>Myriophyllum spicatum</i>	Eurasian milfoil
<i>Cabomba caroliniana</i>	fanwort
<i>Hydrilla</i>	verticillata
<i>Trapa natans</i>	water chestnut
<i>Myriophyllum aquaticum</i>	parrot feather
<i>Potamogeton crispus</i>	curly leaf pondweed
<i>Lythrum salicaria</i> , <i>L. virgatum</i> , <i>L. alatum</i>	purple loosestrife
<i>Phragmites australis</i> or <i>P. communis</i>	common reed
<i>Egeria densa</i>	brazilian elodea
<i>Hydrocharis morsus-ranae</i>	frogbit
<i>Butomus umbellatus</i>	flowering rush
<i>Najas minor</i>	European naiad
<i>Nymphoides peltata</i>	yellow floating heart

There are currently 30 waterbodies in the state with known exotic weed infestations. Milfoil and fanwort have been spreading between New Hampshire's waterbodies since the late 1960s. It's believed that these plants first entered the state's waterbodies from a discarded home aquarium. From there, these nuisance weeds have spread to other lakes in the state. The other weeds listed here have become nuisance species in other states, and may find New Hampshire's waters adequate for infestation.

Exotic plants are known to take over the systems to which they are introduced. They cause a decrease in aesthetic value, recreational value, and monetary value of New Hampshire's waterbodies. In addition, they irreversibly alter the natural native ecology of New Hampshire's waterbodies.

How did this law come about?

Since the mid-1980s, various lakes around the state have been plagued by nuisance aquatic plants, such as exotic milfoil and fanwort. Other plants that do not grow directly in the lake but rather in moist habitats, like roadsides and wetlands, have been spreading rapidly. The pretty purple flower, known as purple loosestrife, and

the tall tufted reed, known as great reed, are becoming common sights along roadways in the state.

To prevent the further spread of these nuisance exotic plants, the N.H. Department of Environmental Services (DES) has drafted rules to make RSA 487:16-a enforceable. These rules include the above listed prohibited species which are already, or may quickly become, nuisance aquatic plants in the state.

Why are these particular plants a problem? Plants which are native to a particular area have attracted a variety of predators, including insects, animals, or pathogens (viruses/fungi), which prevent out-of-control plant growth. Exotic plants have been introduced into the state from areas that are both inside and outside of the United States. Because they are not native to this state, they have no natural predators to moderate their growth. Exotic species are thus able to flourish unchecked in any suitable habitat.

Once established in the state, these nuisance exotic plants can take over large portions of waterbodies. Not only does this affect navigation, recreation, and aesthetics, but exotic plants also pose a threat to many native species and valuable wildlife habitats.

How did these plants find their way into New Hampshire?

There are a variety of sources that are believed to have introduced exotic plant species into the state. Some of these sources are natural and are hard to control. A natural source may include the widening of the species range due to an increase in disturbed areas. Interstate transport of exotic plants may also occur when seeds and plant pieces become attached to migrating birds and waterfowl.

Other sources revolve around the actions of humans. The sale of aquatic plants; dumping of aquaria into New Hampshire waterbodies; importation of plants for distribution or research; boats, vehicles, and trailers traveling between infested and uninfested waterbodies; and even fishing lures and bait buckets with pieces of plants attached can all result in the statewide spread of the nuisance exotic plants. These activities, though numerous, are more easily regulated than natural means of transport.

What can you do to prevent the spread of exotic aquatic plants?

Since the law went into effect, activities involving the 14 listed exotic plants can be effectively managed. There are, however, 33 waterbodies within the state that already have infestations of milfoil, and miles or roadsides and acres of wetlands that are infested by purple loosestrife, great reed, and other exotics.

To prevent the further spread of these exotic species, always check your boats, motors, trailers, vehicles, fishing lures, bait buckets, and any other equipment that may have come in contact with any exotic plant or its habitat. Before you launch your boat, and after you pull it out of the water, give it a good check to make sure that you don't have any tag-along plants. Remove all plants that are attached to your boats, vehicles, or equipment. Dispose of all plants away from the waterbody. Many launch sites have trash cans where you can dispose of the plants. **DON'T THROW THEM BACK IN THE WATER!**

If you are in any field or have a hobby that puts you in contact with any exotic aquatic plants listed in the rules associated with RSA 487:16-a, please be aware of the new law. The law requires that any plants that are listed in the rules and in your possession be destroyed away from any state waterbody.

If you are a distributor or enthusiast of water garden plants, please collect and destroy all exotic aquatic species. There are many native aquatic plants that are suitable for sale and distribution within the state.

How to effectively destroy exotic aquatic plants

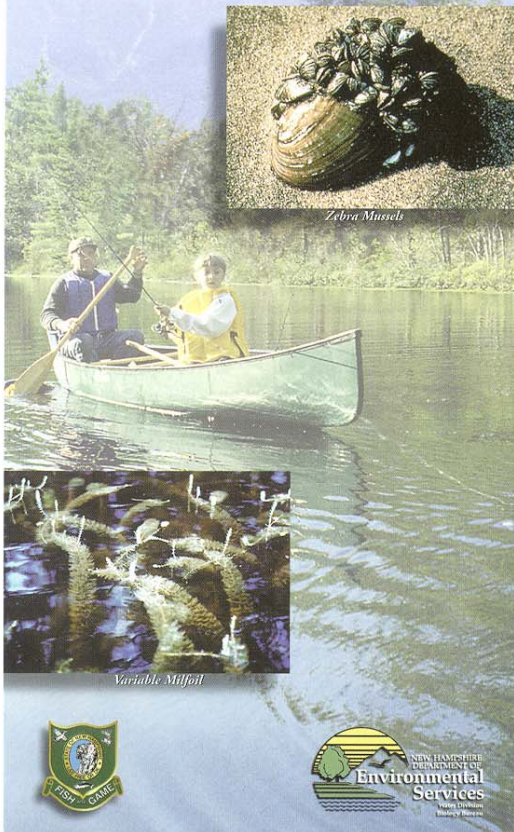
The best way to eliminate the threat which these plants pose is to insure that they are not able to be transported to an area where they are likely to reproduce themselves. Landfilling and burning (permit may be required) are both appropriate means of disposal.

For those plants that are exclusively water-dependent, like milfoil, fanwort and pondweed, alternative methods, such as composting, may be considered. However, the end product of composting should not be applied along shorelines near lakes and ponds, or along the banks of rivers and streams.

If you have any questions or concerns, or would like a copy of the law or the rules, please contact the DES Biology Bureau at (603) 271-3503.

BEFORE YOU BOAT... KNOW WHAT YOU TOTE!

*It's up to YOU to control
aquatic nuisance species*



NOTICE TO BOATERS

Exotic plants and zebra mussels pose a significant risk to the health of New Hampshire's waterbodies. These aquatic nuisance species are transported via boats, trailers, fishing equipment, bait fish and bait buckets, diving gear and other aquatic recreational equipment. It's important to prevent zebra mussels, milfoil, and other aquatic nuisance species from being introduced to New Hampshire's waterbodies. Once established, it's impossible to eradicate these organisms, and management is very expensive. In addition, these exotic aquatic nuisance species each cause significant harm to native species of fish, plants and insects and their natural habitats.

HOW CAN YOU HELP?

LOOK for signs near boat launch sites. These signs warn of any aquatic nuisance species in a waterbody.

REMOVE all materials (plant or animal) from any equipment that has been in contact with an infested waterbody. Dispose of plant or animal material away from the waterbody. **Don't throw it back in the water.**



WASH AND DRY all equipment before using it again. Simply hosing off the boat, diving gear, or trailer may be enough. In some cases, a high-pressure and high-temperature (>140 d. F.) wash or light scraping may be necessary.

DRAIN AND FLUSH the engine cooling system and live wells of your boat, the buoyancy control device from diving equipment, and bait buckets of all plants and organisms.

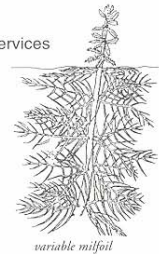
INSPECT your equipment before you launch into, fish, dive, or paddle on another waterbody.

REMEMBER, as of January 1, 1998, it is illegal to transport exotic aquatic plants in New Hampshire.

For more information, contact:

N.H. Department of Environmental Services
(Exotic Weed Program)
6 Hazen Drive
Concord, NH 03301
(603) 271-2963
www.des.state.nh.us

N.H. Fish and Game Department
2 Hazen Drive
Concord NH 03301
(603) 271-2501
www.wildlife.state.nh.us



PUB99001-vy

Appendix Four
NHDES Exotic Aquatic Species Program
Examples of Boat Launch Signs

Appendix Five

NHDES Exotic Aquatic Species Program

Criteria to Evaluate the Selection of Aquatic Plant Management Techniques

**Criteria to Evaluate the Selection of
Aquatic Plant Control Techniques**
NH Department of Environmental Services
Water Division

Preliminary Investigations

I. Field Site Inspection

- Verify genus and species of the plant.
- Determine if the plant is a native or exotic species per RSA 487:16, II.
- Map extent of the plant infestation (area, water depth, height of the plant, density of the population).
- Document any native plant abundances and community structure around and dispersed within the exotic/nuisance plant population.

II. Office/Laboratory Research of Waterbody Characteristics

- Contact the appropriate agencies to determine the presence of rare or endangered species in the waterbody or its prime wetlands.
- Determine the basic relevant limnological characteristics of the waterbody (size, bathymetry, flushing rate, nutrient levels, trophic status, wetlands).
- Determine the potential impacts to downstream waterbodies based on limnological characteristics (water chemistry, quantity, quality).

Determination of Control Practice Based on Preliminary Investigations

Following are a series of control techniques which have been used in New Hampshire in the past, as well as some techniques which are still experimental. The most appropriate technique based on the determinations of the preliminary investigation should be selected. Applicable statutes are included at the end of this report, along with a copy of the Exotic Species Rules adopted September 5, 1998. These are the guidelines which were used to develop the criteria for the selection of a control technique.

Guidelines and requirements of each control practice are detailed below each alternative. A field sheet should be used in conjunction with this list to document the decision making process.

A. Hand-Pulling

- Can be used for exotic or native species.
- Can be used if infestation is in a small localized area.
- Can be used if plant density is low, or if target plant is scattered and not dense.

- Can be used if the plant could effectively be managed or eradicated by hand-pulling a few scattered plants.
- Use must be in compliance with the Wetlands Bureau rules.

B. Mechanically Harvest or Hydro-Rake

- Can not be used on plants which reproduce vegetatively (by fragmentation, ie milfoil, fanwort, etc.) unless containment can be ensured.
- Can be used only if the waterbody is accessible to machinery.
- Can be used if there is a dumping location available for harvested plant materials.
- Can be used if plant depth is conducive to harvesting capabilities (~ <7 ft. for mower, ~ <12 ft. for hydro-rake).
- Funds are available for repeated harvesting activities in that season.
- A navigation channel is required through dense plant growth.

C. Chemical Treatment

- Can be used if application of chemical is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or type of plant.
- Can be used for treatment of exotic plants where fragmentation is a high concern.
- Can be used where species specific treatment is necessary due to the need to manage other plants (rare or endangered that will not be impacted by chemical treatment).
- Can be used if other methods used as first choices in the past have not been effective.
- A licensed applicator should be contacted to inspect the site and make recommendations about the effectiveness of chemical treatment as compared with other treatments.

D. Restricted Use Areas (per RSA 487:17, II (d))

- Can be used for exotic species only.
- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other activities may cause fragmentation to occur.
- Can not be used when there are several “patches” of an infestation of exotic aquatic plants throughout a waterbody.
- Can be used as a temporary means of control.

E. Bottom Barrier

- Can be used for exotic or native species.
- Can be used in small areas, preferably less than 10,000 sq. ft.
- Can be used in an area where the current is not likely to cause the displacement of the barrier.
- Can be used early in the season before the plant reaches the surface of the water.
- Can be used in an area to compress plants to allow for clear passage of boat traffic.
- Can be used in an area to compress plants to allow for a clear swimming area.

F. Drawdown

- Can be used if the target plant(s) are susceptible to drawdown control.
- Can be used in an area where bathymetry of the waterbody would be conducive to an adequate level of drawdown to control plant growth, but where extensive deep habits exist for the maintenance of aquatic life such as fish and amphibians.
- Can be used where plants are growing exclusively in shallow waters where a drawdown would leave this area “in the dry” for a suitable period of time (over winter months) to control plant growth.
- Can be used in winter months to avoid encroachment of terrestrial plants into the aquatic system.
- Can be used if it will not significantly impact adjacent or downstream wetland habitats.
- Can be used if spring recharge is sufficient to refill the lake in the spring.
- Can be used in an area where shallow wells would not be significantly impacted.

G. Dredge

- Can be used in conjunction with a scheduled drawdown.
- Can be used if a drawdown is not scheduled, though a hydraulic pumping dredge should be used.
- Can only be used as a last alternative due to the detrimental impacts to environmental and aesthetic values of the waterbody.

H. Biological Control

- Grass carp cannot be used.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant.
- Research should be conducted on a potential biological control prior to use to determine the extent of host specificity.